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Development of Coatings Performance Specifications for Steel Exposed to the Atmosphere

Aluminum Epoxy Mastic and Epoxy/Urethane Systems

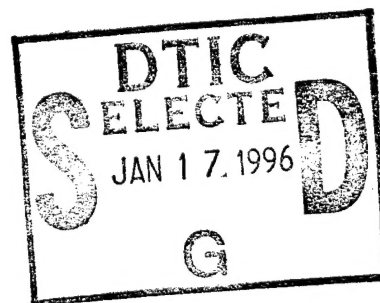
by

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Provisions of the Clean Air Act Amendments of 1990 will restrict the use of high solvent-content paints beginning in 1996. Procurement reform indicates the use of other than military specifications and emphasizes the use of commercial products and performance specifications. In response to procurement reform and air quality regulations, the U.S. Army Corps of Engineers must replace some of its existing coating specifications.

This study developed two performance-oriented commercial item descriptions (CIDs) describing aluminum epoxy mastic and epoxy primer/polyurethane topcoat systems for use on minimally prepared steel surfaces that will be exposed to atmospheric corrosion. Accelerated corrosion tests were conducted to establish the performance envelope of these generic types of coating systems. Ten products, representative of each coating system, were exposed and evaluated for blistering, rusting, and rust undercutting. Standard Corps of Engineers coating systems were used as experimental controls and to establish the relative performance of the test coatings.

The study recommends that the Corps submit the draft CIDs to General Services Administration for review and authorization. Further, it is recommended that the Corps implement the authorized documents by inclusion in CWGS-09940, *Painting: Hydraulic Structures and Appurtenant Works*.



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Foreword

This study was conducted for the Electrical and Mechanical Branch, Engineering Division, Directorate of Civil Works, Headquarters, U.S. Army Corps of Engineers (HQUSACE) under "Civil Works Investigations and Studies"; Work Unit 31205, "Developing High Performance Coatings." The technical monitors were R. Kinsel and J. Gilson, CECW-EE

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Contents

SF 298	1
Foreword	2
1 Introduction	5
Background	5
Objective	8
Approach	8
Scope	8
Mode of Technology Transfer	9
2 Evaluation of Aluminum Epoxy Mastic Coating Systems	10
Selection of Test Coatings	10
Preparation of Test Specimens	10
Test Methods	11
Inspection and Evaluation of Test Coupons	12
Aluminum Epoxy Mastic Test Results and Discussion	12
3 Evaluation of Epoxy Primer/Urethane Topcoat Systems	15
Selection of Test Coatings	15
Preparation of Test Specimens	15
Test Methods	15
Inspection and Evaluation of Test Coupons	15
Epoxy/Urethane Test Results and Discussion	16
4 Determination of Coating System Salient Characteristics	19
Commercial Item Descriptions	19
Salient Characteristics for Aluminum Epoxy Mastic and Epoxy/Urethane Systems	19
5 Conclusions and Recommendations	21
Performance of Aluminum Epoxy Mastics Versus Standard Corps System	21
Performance of Epoxy/Urethane Systems Versus Standard Corps System	21
Commercial Availability	21
Air Pollution Regulations	22
General Services Administration	22
Corps of Engineers	22
Bibliography	23

Appendix A:	Aluminum Epoxy Mastic Test Results	A1
Appendix B:	Epoxy/Urethane System Test Results	B1
Appendix C:	Commercial Item Description of a Coating System for Minimally Prepared Atmospheric Steel–Aluminum Epoxy Mastic	C1
Appendix D:	Commercial Item Description of a Coating System for Minimally Prepared Atmospheric Steel–Epoxy Primer/Urethane Topcoat	D1

Distribution

1 Introduction

Background

Historic Perspective

Structures operated and maintained by the U.S. Army Corps of Engineers contain millions of square feet of steel.* Protective coatings are used to extend the useful life of the steel and ultimately the structures they comprise. Any of a number of surface preparations and coatings may be used to protect a steel surface depending on the environment and intended use of the painted structure. A steel surface immersed in water, for example, will have distinctly different requirements from one exposed to the atmosphere.

Cost-effective corrosion protection in immersion requires rigorous surface preparation as defined in various specifications. Generally, the level of surface preparation that will be specified under given circumstances is the lowest level that will provide good coating performance. SSPC-SP 5, *White Metal Blast Cleaning*, or SSPC-SP 10, *Near-White Metal Blast Cleaning*, are typically specified for surfaces that will be immersed in fresh or salt water. Lesser degrees of surface preparation such as specified in SSPC-SP 2, *Hand Tool Cleaning*, SSPC-SP 3, *Power Tool Cleaning*, SSPC-SP 7, *Brush-Off Blast Cleaning*, or SSPC-SP 6, *Commercial Blast Cleaning* are usually specified for atmospheric exposures. Historically, the Corps of Engineers has specified SSPC-SP 3 and SSPC-SP 7 for atmospheric painting (CWGS-09940 June 1993; CW-09940 October 1992; CW-09940 August 1989; CW-09940 August 1981; CW-09940 April 1981; CW-09940 November 1979; CW-09940 January 1977; CE-1409 June 1973; and CE-1409 March 1968).

Coatings formulated for use on steel surfaces cleaned in accordance with SSPC-SP 2, SSPC-SP 3, or SSPC-SP 7 are often called "surface-tolerant coatings" (Kapsanis and Appleman 1992). This term derives from the fact that these surface preparation methods may leave traces of surface contaminants such as rust, salts, and old paint. Specific types of surface-tolerant coatings are formulated to provide good protection over these types of contaminated surfaces. Oil-based, long oil alkyd, and modified versions of these coatings containing inhibitive pigments are traditional types of

* 1 sq ft = 0.093 m².

surface-tolerant coatings (Thomas 1989). Red-lead linseed oil primer is a classic example of an oil-based surface-tolerant coating containing an inhibitive pigment.

Historically, the Corps has used coatings such as "TT-P-86 Paint, Red Lead-Based, Ready-Mixed" and "TT-P-615 Primer Coating: Basic Lead Silico Chromate" for priming steel exposed to the atmosphere (CW-09940 [August 1989, August 1981, April 1981, November 1979, January 1977], CE-1409 [June 1973, March 1968]). However, the use of TT-P-615 was discontinued in the August 1989 guide specification revision. The use of TT-P-86 was limited to maintenance painting in 1989 and was also discontinued in 1992. Use of these primers was curtailed because of worker safety and environmental concerns surrounding lead and chromium-pigmented coatings. "SSPC-Paint 25 Red-Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer" was added to the guide specification in 1989. Oil-based, alkyd, and modified versions of these resins are used to topcoat surface-tolerant primers of similar resin chemistries. Traditionally the Corps has used "TT-P-38 Paint, Aluminum, Ready Mixed" and "TT-E-489 Enamel, Alkyd, Gloss," as topcoats for TT-P-86, TT-P-615, and SSPC-Paint 25. TT-P-38 is a tung oil-modified phenolic material pigmented with leafing aluminum. TT-E-489 is used when colors such as black, white, or yellow are required.

Technology Drivers

Most of the research dollars in both the coatings industry and government are spent on developing new coating technologies with reduced levels of organic solvents. Local and state environmental regulations place limits on the volatile organic compound (VOC) content of architectural and industrial maintenance coatings. In response to the Clean Air Act Amendments of 1990, the U.S. Environmental Protection Agency (USEPA) is developing a national rule governing VOCs in architectural and industrial maintenance coatings. The private sector is leading the effort to produce low-VOC technologies, but recently, government paint specifications have generally fallen behind the state-of-the-science and the government has been slow to adopt new paint technologies.

Today the hazards associated with lead and chromium pigments are well known. The Corps response to these hazards has been to eliminate the use of these materials on Corps jobs. SSPC-Paint 25 has replaced lead- and chromium-pigmented paints. Paint 25 is a good coating material, but is based on a relatively old technology. Like the traditional Federal Specification and Corps of Engineers paints, Paint 25 is a "formula specification." Such specifications, which are based primarily on the content of the coating, circumscribe the introduction of new and innovative products.

Federal procurement reform favors the use of performance-based specifications and commercially available materials. Materials made to conform to Military and other material specifications are rarely sold to the general public; in other words, they are not manufacturers' shelf products.

Rationale for Performance Specifications

The Corps has traditionally used paint specifications that are based on a material's composition, known as "formula specifications." Formula specifications used by the Corps include those prepared by the Corps, Army, Air Force, General Services Administration (GSA), Navy, and the Steel Structure Painting Council (SSPC).^{*} Acquisition reform will largely phase out military specifications prepared by the Army, Navy, and Air Force for use within the Corps by the end of 1995.

Procuring items without specific requirements is risky; unless requirements are properly defined and specified, one may choose a paint that is unsuitable in terms of the quality, performance, or fitness for a given application. The Corps needs an alternative to the traditional formula-based military specifications. Specifications based on a material's performance may provide the required alternative to formula specifications. A public sector procurement system based on performance specifications would offer the dual advantage of promoting competition while providing for a high quality product. However, government procurement documents must specify requirements without favoring individual manufacturers or proprietary products. Requiring the use of specific proprietary products in procurement documents is usually not allowed because it does not promote full and open competition.

GSA is the preparing activity for a number specifications known as Commercial Item Descriptions (CIDs), which may be based solely on performance, but often incorporate some compositional requirements. CIDs are intended for use in procurement documents for a class of commercially available products. SSPC is in the process of developing performance specifications similar to GSA's CIDs. The American Society for Testing and Materials (ASTM)^{**} has some existing standards for coated items that are based on performance of the coated end product.

Accelerated tests are the most practical tool available to quickly assess coating performance. Field exposures and fence tests, while more reliable, take too long to be practical. Accelerated test methods, if used wisely, can reliably predict the relative performance of coatings and can thereby help produce performance specifications for

^{*} Steel Structure painting Council, 4516 Henry St., Pittsburgh, PA 15213

^{**} American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19102-1187.

generic classes of coatings such as barrier epoxy coatings, as a practical alternative to formula specifications.

Corps of Engineers Requirements for Paints for Atmospheric Steel

The factors driving technology within the coatings industry as well as current trends in procurement propelled by acquisition reform have combined to form the basis for most of the requirements for paints designed for use on steel exposed to atmospheric corrosion. New specifications adopted for use by the Corps should not be military specifications. Ideally, coatings specified by the Corps will be free of hazardous lead and chromium pigments, will contain low levels of VOCs, and will be based on performance rather than formula specifications.

Objective

The objective of this research was to develop performance-based material specifications to describe commercially available products that:

1. Are suitable for painting atmospheric steel
2. Are compatible with current Corps painting practices
3. Meet the demands of acquisition reform
4. Meet the requirements of air pollution regulations.

Approach

Twenty commercial products representing two generic coating systems were evaluated in accelerated weathering tests. The performance envelope for each generic system was determined, performance requirements were established, and draft performance specifications were developed.

Scope

The results of this study are applicable to Civil Works painting of steel surfaces exposed to atmospheric weathering. The research was not conducted to validate the performance of, or to qualify individual products for use within the Corps of Engineers. The results of the research are intended solely to develop performance-based materials specifications for use by the Corps and other Federal agencies. The results contained herein do not represent an endorsement of any manufacturer or specific product.

Mode of Technology Transfer

The appended draft performance specifications will be submitted to General Services Administration (GSA Center, ATTN: 9FTE-10, Auburn, WA 98001, TEL: 206/931-7929, FAX: 206/931-7544) for review and adoption as CIDs. It is recommended that on implementation by GSA, the CIDs become standard coating systems within the Corps by adoption and reference in CWGS-09940, *Painting: Hydraulic Structures and Appurtenant Works*.

2 Evaluation of Aluminum Epoxy Mastic Coating Systems

Selection of Test Coatings

Epoxy coatings pigmented with aluminum offer an alternative to the use of traditional surface-tolerant coatings (Thomas 1989, Hare 1989, Hare 1990). Ten commercially available aluminum epoxy coatings were selected for evaluation. The selected coatings are manufactured in the United States and have a maximum VOC as applied of 340 grams per liter (g/L). The selected test coatings are compatible with minimally prepared rusted steel substrates. Table 1 lists the 10 aluminum epoxy mastic systems evaluated in this study.

Preparation of Test Specimens

Cold-rolled steel test panels measuring 3.0 x 9.0 in. were initially abrasive blast cleaned to SP-10 to promote the formation of uniform corrosion.* The test panels were then rusted to an initial condition approximating Hand Tool Cleaned (SP-2) steel prepared from steel of condition C of SSPC-Vis 1, by spraying atomized deionized water onto the test panels 10 times a day for 5 days. The test panels were allowed to dry completely prior to rewetting.

The 10 coating systems were applied in accordance with manufacturers' recommended procedures. Where the manufacturer provided an option to apply the coating system in one or two spray applications, two were used. Test panels were scribed prior to exposure in such a manner that the coating was uniformly removed down to the substrate along the entire length of the scribe. The dry film thickness of each coat of each system was measured using a nondestructive magnetic dry film thickness gage. Average dry film thicknesses for each system are listed in Table 1. Dry film thicknesses for individual panels can be found in Appendix A.

* 1 in. = 25.4 mm.

Table 1. Aluminum epoxy mastic coating system.

Manufacturer	Product Name	VOC (g/L)	Dry Film Thickness (0.001 in)
Davis Industrial Paint	SSPC Paint 25 TT-P-38 (2 coats)	~290 ~430	2.2 1.3 2.1 5.6 (total)
Sherwin-Williams	Epoxy Mastic Aluminum II (2 coats)	173	6.8 5.3 12.1 (total)
Sherwin-Williams	Surface Tolerant Epoxy Coating (2 coats)	174	6.0 5.5 11.5 (total)
Devoe	Bar Rust 239 Aluminum Epoxy Mastic (2 coats)	86	6.2 8.2 14.4 (total)
Sigma Coatings	Colturiet TCP Aluminum (2 coats)	239	5.9 6.5 12.4 (total)
International	Magna Mastic 7900 (1 coat)	121	5.5 (total)
International	Intergard Universal Aluminum (1 coat)	192	7.3 (total)
Caboline	Carbomastic 15LO (2 coats)	88	5.0 5.4 10.4 (total)
Carboline	Carbomastic 90 (2 coats)	84	5.2 6.0 11.2 (total)
Sherwin-Williams	Macropoxy Aluminum (2 coats)	175	6.3 4.1 10.4 (total)
Hempel	Hempadur 4515-1987 (2 coats)	180	7.8 8.7 16.5 (total)

Test Methods

Recent advancements have been made in developing more reliable accelerated test methods. One such method is the use of a cyclic corrosion chamber that incorporates a drying cycle and uses a dilute aqueous salt solution. This cyclic test is described in ASTM G 85, *Standard Practice for Modified Salt Spray (Fog) Testing, Annex A5. Dilute Electrolyte Cyclic Fog/Dry Test* (1994). This test procedure, coupled with ASTM G 53, *Standard Practice for Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) for Exposure of Nonmetallic Materials* (1991), reportedly produces coating failure modes similar to those observed in actual atmos-

pheric weathering and results in improved rank correlations between exterior-exposed and laboratory-exposed test panels (Simpson, Ray, and Skerry 1991).

Six test panels from each system were exposed in a slightly modified version of a G 53/G 85 cyclic test. The concentration of the dilute salt solution was 0.4 percent ammonium sulfate and 0.05 percent sodium chloride. The salt spray temperature was 30 °C and the dry-off temperature was 40 °C. The UV-condensing cabinet was run at 60 °C during the 4h UV cycle (UV-A bulbs) and at 50 °C during the 4h condensation cycle. Samples were exposed for 1 week in the G 53 cabinet followed by 1 week in the G 85 cabinet. Coating system Number 2 from CWGS-09940 was used as an internal control. This system consists of "SSPC-Paint 25" (1st coat) and "TT-P-38, Paint, Aluminum, Ready Mixed" (2d and 3d coats).

The aluminum epoxy coatings were also evaluated for ease of application, mixing properties, sag resistance, leveling properties, film build properties, and ease of cleanup.

Inspection and Evaluation of Test Coupons

The coatings were periodically evaluated for rusting, blistering, and rust undercutting at the scribe in accordance with ASTM D610, SSPC-Vis. 2, ASTM D714, and ASTM D1654. A transparent grid overlay was used to enhance the results of the visual examination. Panels were rated at 336, 672, 1344, 2016, 2688, 3360, and 4032 hours.

Aluminum Epoxy Mastic Test Results and Discussion

The results of the periodic evaluations of the aluminum epoxy mastic coating systems exposed in the cyclic salt spray test are detailed in Appendix A and summarized in Table 2. Column 2 of Table 2 indicates the first appearance of blistering and the number of panels affected. Blistering at subsequent intervals is similarly indicated. Unless otherwise indicated, blistering occurred adjacent to the scribe and not over the entire face of the panel. First appearance of surface rusting is indicated in column 3 along with number of panels affected. Early rusting is often a good indicator of poor long-term performance. Column 4 shows the results of the rust undercutting analysis performed after completing the cyclic salt spray test. The first number indicates the lowest rating of the six test panels and the second number is the average numerical rating for all six panels. Column 5 lists the average numerical ratings and composite score for each coating system. The numerical rating for blistering is based only on the area adjacent to the scribe and not on the entire facial area of the test panels. The

Table 2. Aluminum epoxy mastic performance in cyclic salt spray test (4032 h).

Coating System	Blister – Occurrence at Scribe (# Panels)	Rust – First Occurrence (# Panels)	Scribe – Worst / Average Numerical Rating	Numerical – Blister / Rust / Scribe / Total
SSPC Paint 25 TT-P-38	3360 (6) 4032 (6)	672 (6)	7 / 8.8	7.2 / 9.2 / 8.8 / 25.2
S-W Ep Mastic Alum II S-W Ep Mastic Alum II	4032 (0)	672 (4)	6 / 6.3	10.0 / 9.0 / 6.3 / 25.3
S-W Sur Tol Epoxy S-W Sur Tol Epoxy	3360 (6) 4032 (6)	672 (2)	5 / 5.8	5.2 / 9.5 / 5.8 / 20.5
Devco Bar Rust 239 Devco Bar Rust 239	4032 (6)	672 (3)	6 / 6.8	7.3 / 9.3 / 6.8 / 23.5
Sigma Colturiet TCP Sigma Colturiet TCP	3360 (6) 4032 (6)	672 (1)	6 / 6.8	5.2 / 9.5 / 6.8 / 21.5
International Magna Mastic 7900 (1 coat)	2016 (2) not just at scribe 2688 (4) 3360 (6) 4032 (6)	672 (6)	9 / 9.0	5.3 / 1.7 / 9.0 / 16.0
International Intergard Universal Alum (1 coat)	3360 (6) 4032 (6)	672 (1)	6 / 8.0	6.5 / 9.5 / 8.0 / 24.0
Carbomastic 15LO Carbomastic 15LO	3360 (2) 4032 (5)	672 (1)	8 / 9.0	6.7 / 9.3 / 9.0 / 25.0
Carbomastic 90 Alum Carbomastic 90 Alum	4032 (3)	672 (1)	9 / 9.7	9.0 / 9.3 / 9.7 / 28.0
S-W Macropoxy Alum S-W Macropoxy Alum	3360 (6) 4032 (6)	none at 4032	4 / 5.7	4.2 / 10.0 / 5.7 / 19.9
Hempadur 4515-1987 Hempadur 4515-1987	2016 (1) 2688 (1) 3360 (6) 4032 (6)	none at 4032	5 / 6.0	3.8 / 10.0 / 6.0 / 19.8
Totals all AEM	2016 (0.3) 2688 (0.5) 3360 (3.8) 4032 (5.0)	672 (1.9)	6.6 / 7.3	6.3 / 7.8 / 7.3 / 21.4
Control	3360 (6) 4032 (6)	672 (6)	7 / 8.8	7.2 / 9.2 / 8.8 / 25.2

numerical blister rating is the average of the sum of the numerical ratings for blister frequency and size. Blister frequency is converted as follows: none = 10, few = 8, medium = 6, medium dense = 4, dense = 2, complete = 0. Averages for the 10 aluminum epoxy mastic systems are shown at the bottom of Table 2.

Early blistering is also known to correlate well with inferior long-term performance. On the average, first blistering occurred after 3360 hours of testing. This is true of 5 of the 10 epoxy systems as well as the control. First blistering occurred later (4032 h) or not at all for 3 epoxies and earlier for 2 others. One epoxy system experienced blistering over the entire panel and not just adjacent to the scribe. The final average

blister rating for the group of epoxies was slightly lower than that observed for the control system, 6.3 versus 7.2. Three of the epoxy systems were more resistant to blistering than the control and two of these also had high composite scores.

First rusting typically appeared at the second inspection interval (672 h). This is true of all but two epoxy systems that did not exhibit surface rusting for the duration of the test exposure. Appearance of first rusting did not differ greatly between the control system and epoxy coatings. The average final rust rating of the epoxies was much lower than observed for the control system. However, all but one epoxy system scored near or above the control system while one product offered little corrosion protection in this test. The average rust rating of the nine best epoxies was 9.6.

The average rating for rust undercutting did not deviate drastically between test specimens for a given coating system. The average numerical rating for undercutting the epoxy systems was significantly lower than for the control system, 7.3 versus 8.8. However, three epoxy systems had better resistance to undercutting than the control system and two of these had excellent composite scores.

The average composite score of the aluminum epoxy mastics was significantly lower than the control system, 21.4 versus 25.2. Only two of the epoxy systems outperformed the control system. Overall, six of the aluminum epoxy mastic systems exhibited good to excellent performance, three fair, and only one poor.

3 Evaluation of Epoxy Primer/Urethane Topcoat Systems

Selection of Test Coatings

Ten commercially available epoxy/urethane coating systems were selected for evaluation. The selected systems are American made. The test coatings have a maximum VOC as applied of 340 g/L for the epoxy primer and 450 g/L for the urethane topcoat. The selected coatings are compatible with minimally prepared rusted steel substrates. Table 3 lists the epoxy/urethane coating systems.

Preparation of Test Specimens

Test panels were prepared and coatings were applied in the same manner as described above for the aluminum epoxy mastic coating systems. Standard Corps of Engineers coating system number 16 was applied as a control. This system, described in CWGS-09940, consists of SSPC Paint No. 25 (1st coat) and TT-E-489 (2d and 3d coats). Average dry film thicknesses for each system are listed in Table 3. Dry film thicknesses for individual panels can be found in Appendix B.

Test Methods

Test panels were exposed as described above for the aluminum epoxy mastic coating systems.

Inspection and Evaluation of Test Coupons

The coatings were periodically evaluated as described for the aluminum epoxy mastic coating systems except that panels were rated at 336, 672, 1344, 2016, 2688, and 3360 hours. In addition to corrosion degradation, each test system was evaluated for percent gloss retention. Gloss retention is primarily an appearance consideration and is not necessarily an indicator of coating performance.

Table 3. Epoxy/urethane coating systems.

Manufacturer	Product Name	VOC (g/L)	Dry Film Thickness (0.001 in)
Davis Industrial Paint	SSPC Paint 25 TT-P-489 (2 coats)	~290 <420	2.0 2.6/3.2 7.8 (total)
Carboline	Carbomastic 90 Carbothane 134HS	84 288	6.0 4.7 10.7 (total)
International	Intergard HS Universal Epoxy Interthane	192 414	6.1 3.4 9.5 (total)
Devoe	Bar Rust 236 Devthane 379	170 327	5.0 3.6 8.6 (total)
Sherwin-Williams	Surface Tolerant Epoxy High Solids Polyurethane	174 289	6.7 3.0 9.6 (total)
Devoe	Bar Rust 239 Devthane 379	86 327	5.7 3.3 9.0 (total)
Hempel	Hempadur 4515/1987 Hempathane 5521/1148	180 450	8.0 1.9 9.9 (total)
Sherwin-Williams	Macropoxy Acrothane	175 346	5.5 2.2 7.7 (total)
Sigma Coatings	EPTCP Aluminum VHSA Polyurethane	240 372	6.5 3.9 10.4 (total)
Carboline	Carbomastic 15LO Carbothane 134HS	88 288	5.4 6.8 12.2 (total)
Devoe	Devran 224 Devthane 379	340 327	5.1 3.0 8.1 (total)

Epoxy/Urethane Test Results and Discussion

The results of the periodic evaluations of the epoxy/urethane coating systems exposed in the cyclic salt spray test are detailed in Appendix B and summarized in Table 4. Column 2 of Table 4 indicates the first appearance of blistering and the number of panels effected. Blistering at subsequent intervals is similarly indicated. Column 3 shows the percent gloss retention. Column 4 shows the results of the rust undercutting analysis performed after completion of the cyclic salt spray test.

Table 4. Epoxy/urethane performance in cyclic salt spray test (3360h).

Coating System	Blister - Occurrence at Scribe (# Panels)				Gloss Retention	Scribe - Worst and Average Numerical Rating	Numerical - Blister / Rust / Scribe / Total
SSPC 25 TT-E-489	1344	2016	2688	3360	58.0%	5 / 6.7	3.6 / 10 / 6.7 / 20.3
Carbomastic 90 Carbothane 134HS	1344	2016	2688	3360	90.4%	8 / 8.7	8.7 / 10 / 8.7 / 27.4
Intergard HS Interthane	1344	2016	2688	3360	94.1%	8 / 9.0	9.0 / 10 / 9.0 / 28.0
Bar Rust 236 Devthane 379	1344	2016	2688	3360	92.3%	5 / 6.7	3.7 / 10 / 6.7 / 20.4
S-W Sur Tol Epoxy S-W Hi Sol PU	1344	2016	2688	3360	38.1%	8 / 8.8	9.3 / 10 / 8.8 / 28.1
Bar Rust 239 Devthane 379	1344	2016	2688	3360	13.7%	6 / 6.5	4.0 / 10 / 6.5 / 20.5
Hempadur 1987 Hempathane 1148	1344	2016	2688	3360	99.3%	6 / 6.8	2.8 / 10 / 6.8 / 19.6
S-W Macropoxy S-W Acrothane	1344	2016	2688	3360	70.3%	5 / 6.2	2.7 / 10 / 6.2 / 18.9
Sigma EPTCP Sigma VHSA PU	1344	2016	2688	3360	92.1%	8 / 8.5	5.8 / 10 / 8.5 / 24.3
Carbomastic 15LO Carbothane 134HS	1344	2016	2688	3360	95.4%	6 / 7.8	8.3 / 10 / 7.8 / 26.1
Devran 224 Devthane 379	1344	2016	2688	3360	99.3%	5 / 6.5	4.5 / 10 / 6.5 / 21.0
Totals all e/u coatings Control	1344 3.30 4	2016 3.50 6	2688 4.20 6	3360 4.30 6	78.5% 58.0%	6.5 / 7.5 5.0 / 6.7	5.9 / 10 / 7.5 / 23.4 3.6 / 10 / 6.7 / 20.3

The first number indicates the lowest rating of the six test panels and the second number is the average numerical rating for all six panels. Column 5 lists the average numerical ratings and composite score for each coating system. The numerical rating

for blistering is based only on the area adjacent to the scribe and not on the entire facial area of the test panels. Averages for the 10 epoxy/urethane systems are shown at the bottom of Table 4.

Early blistering is known to correlate well with inferior long-term performance. On average first blistering occurred after 1344 hours of testing. This is true of seven of the 10 epoxy/urethane systems as well as the control. First blistering occurred later (2688 h) for three epoxy/urethane systems. The final average blister rating for all of the epoxy/urethane systems was significantly higher than that observed for the control system, 5.9 versus 3.6. Eight of the epoxy/urethane systems are more resistant to blistering than the control system. Blistering was only observed adjacent to the scribe and general blistering was not seen for any of the coating systems.

Early rusting in accelerated testing is often a sign of poor long-term performance. None of the epoxy/urethane systems or the control exhibited any surface rusting for the duration of the test.

The average numerical rating for rust undercutting did not deviate drastically between test specimens for a given coating system. The average numerical rating for undercutting for the epoxy/urethane systems was slightly better than for the control system, 7.5 versus 6.7. Seven epoxy/urethane systems have as good or better resistance to undercutting than the control system.

The average percent gloss retention for the epoxy/urethane systems is significantly better than the control system, 78.5 versus 58.0 percent. All but two of the test systems have gloss retentions superior to the control.

The average composite score of the epoxy/urethane systems was significantly higher than the control system, 23.4 versus 20.3. Only two of the epoxy/urethane systems failed to outperform the control system. Overall, five of the epoxy/urethane systems exhibited good to excellent performance and five fair performance.

4 Determination of Coating System Salient Characteristics

Commercial Item Descriptions

GSA authorizes the use of a wide variety of CIDs including those for protective coatings and related materials. GSA is usually the preparing activity for these CIDs, but this is not a requirement. In some cases, a DOD agency is the preparing activity; for example the Navy is the preparing activity for "CID, A-A-50542, Coating System: Reflective, Slip-Resistant, Chemical-Resistant Urethane for Maintenance Facility Floors."

CIDs are flexible procurement documents. There is no single format or prescription, although CIDs prepared by GSA follow a fairly well established format, including a title, description of salient characteristics, certification, regulatory, and packaging, packing, and marking requirements, and in some cases, quantitative requirements. A-A-50542, prepared by the Navy, is much longer than the average GSA-prepared CID and includes additional sections on quality assurance and supply sources. The description of the salient characteristics is the heart of the CID.

Salient Characteristics for Aluminum Epoxy Mastic and Epoxy/Urethane Systems

Appendixes C and D contain draft CIDs for aluminum epoxy mastic and epoxy/urethane systems for use on minimally prepared atmospherically exposed steel surfaces. The draft CIDs closely follow the format of the Navy prepared CID, A-A-50542, and include an abstract, salient characteristics, notes, and sections on quality assurance and packaging.

The abstract presents a brief description of the product and its intended use. The salient characteristics section presents the requirements for the basic properties and performance requirements for the coating system. The quality assurance section spells out responsibilities, and inspection and certification requirements. The packaging section contains provisions for labeling and packaging, and safety and application data requirements. The notes provide additional relevant information including usage constraints, timeliness for qualification, and sources of products.

The salient characteristics are the most important part of the CID and the rationale behind each of the requirements is therefore also important. The application properties and appearance of the dried paint film provide for defect-free application and curing at the manufacturers' recommended film thickness as applied by commonly used application methods. The dry time requirements are consistent with applying a two-coat system in a 2-day period. The pot life requirements provide for a material that remains usable over a reasonable period of time. Intercoat adhesion requirements ensure that the coating can be successfully topcoated even after a moderate delay in the painting schedule. Requirements for accelerated corrosion assure a level of corrosion protection consistent both with existing Corps painting practices and superior products of the type being evaluated. Requirements for volatile organics ensure compliance with environmental regulations where applicable and with DOD goals associated with pollution prevention.

5 Conclusions and Recommendations

Performance of Aluminum Epoxy Mastics Versus Standard Corps System

Four of the 10 aluminum epoxy mastic systems evaluated meet the performance criteria established in the draft CID. Three of these materials exhibit better overall performance in accelerated corrosion testing than does the standard Corps system for this application. The four products meeting the draft criteria have slightly superior resistance to blistering and slightly inferior resistance to rust undercutting in comparison with the standard Corps system. Rust inhibitive primers, such as those used in the standard Corps system, are more effective at reducing undercutting at film discontinuities and damaged areas than are thick film barrier systems such as epoxies. Conversely, barrier epoxy coatings often provide superior moisture and blister resistance. Overall, coatings complying with the requirements of the draft CID should provide excellent corrosion protection over minimally prepared steel surfaces.

Performance of Epoxy/Urethane Systems Versus Standard Corps System

Four of the 10 epoxy/urethane systems evaluated meet the performance criteria established in the draft CID. Each of these materials exhibit better overall performance in accelerated corrosion testing than does the standard Corps system for this application. Four other systems also outperformed the Corps standard; however, each of these systems exhibited early blistering adjacent to the scribe that progressed to a greater extent than the systems meeting the criteria. Overall, coatings complying with the requirements of the draft CID should provide excellent corrosion protection over minimally prepared steel surfaces.

Commercial Availability

Aluminum epoxy mastic and epoxy/urethane systems are widely available. The products evaluated here represent a small cross section of the available products. CIDs for these systems should make these products widely available to the Corps as well as to other federal end users.

Air Pollution Regulations

Air pollution regulations stemming from the Clean Air Act Amendments of 1990 and earlier legislation place limitations on the amount of volatile organic solvents that paints may contain. The USEPA is working to establish a rule with a national scope for architectural and industrial maintenance coatings. However, at this time the USEPA has not produced a final rule and the exact categorization and allowable VOC contents are subject to speculation. Existing and proposed rules in California and other states offer a more well-defined target. A review of USEPA deliberations and proposed and existing state and local rules suggests an upper limit of 340 g/L for industrial maintenance coatings. This limit is recommended for the aluminum epoxy mastic system and the epoxy primer of the epoxy/urethane system. Half of the urethane topcoats evaluated either approach or exceed the 340 g/L level. An interim VOC level of 420 g/L for the urethane topcoat is recommended.

General Services Administration

It is recommended that the draft CIDs for aluminum epoxy mastic and epoxy/urethane systems be submitted to GSA for coordination, review, and authorization.

Corps of Engineers

It is recommended that the Corps revise CWGS-09940 to include the subject CIDs. The CIDs should be established as alternatives to systems number 2 and 16 of CWGS-09940.

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Appendix A: Aluminum Epoxy Mastic Test Results

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME			
RH			
TEMPERATURE			
SUBSTRATE CONDITION			
COATING BATCH NUMBERS			
THINNING			
EQUIPMENT			
NUMBER OF COATS			
SAG INDEX			
1st COAT			
3/9/93 @ 1:00 P.M.			
55%			
72F			
SSPC VIS 1-C @ 2.0 MILS PROFILE			
A: 23A7722L / B: 3A7697L			
#76 @ 20%			
DEVILBISS MBC 704E			
1ST			
> 24 MILS / 9 MILS THINNED 20%			
2nd COAT			
3/10/93 @ 2:00 P.M.			
63%			
73F			
CARBOMATIC 15LO			
A: 3A7722L / B: 3A7697L			
#76 @ 20%			
DEVILBISS MBC 704E			
2ND			
9 MILS THINNED 20%			
1st COAT			
4.6			
5.3			
5.4			
5.2			
4.8			
4.7			
2nd COAT			
6			
6			
5			
4.4			
5.0			
5.3			
TOTAL			
10.6			
11.3			
10.4			
9.6			
10.4			
10			
DRY FILM THICKNESS, MILS			
SAMPLE 55			
SAMPLE 56			
SAMPLE 57			
SAMPLE 58			
SAMPLE 59			
SAMPLE 60			

AL55-60.XLS

PANEL EVALUATION		CARBOMASTIC 15LO					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 4/5/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							
TEST PANEL NUMBER	55	56	57	58	59	60	COMMENTS
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	changes on any panels in
							this set after 336 hours of
							exposure.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED							
OR COATED SPECIMENS SUBJECTED							
TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE,							
TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE,							
TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS,							
TABLE 2, % FAILED	0	0	0	0	0	0	0
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	10

PANEL EVALUATION		CARBOMASTIC 15LO						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/19/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER	55	56	57	58	59	60	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0.03%		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	9		

PANEL EVALUATION		CARBOMASTIC 15LO					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 6/14/93							
EVALUATION HOURS: 2016							
COATING EVALUATION DATA							
TEST PANEL NUMBER	55	56	57	58	59	60	COMMENTS
ASTM D610 RUST GRADE	0	0	0	0	0.03%	0.03%	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	9	

AL55-60.XLS

PANEL EVALUATION		CARBOMASTIC 15LO																							
CLIENT: U.S. Army Corp of Eng.																									
ALUMINUM/EPOXY MASTIC PROGRAM																									
DATE: 7/12/93																									
EVALUATION HOURS: 2688																									
COATING EVALUATION DATA																									
TEST PANEL NUMBER	55	56	57	58	59	60	COMMENTS																		
ASTM D610 RUST GRADE	0.10%	0	0	0	0.10%	0.10%																			
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																			
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																			
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER																									
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																									
TABLE 2, RATING # OF UNSCRIBED AREAS																									
<table border="1"> <thead> <tr> <th colspan="6">FINAL EVALUATION ONLY</th> </tr> </thead> <tbody> <tr> <td><1%</td> <td>0</td> <td>0</td> <td>0</td> <td><1%</td> <td><1%</td> </tr> <tr> <td>9</td> <td>10</td> <td>10</td> <td>10</td> <td>9</td> <td>9</td> </tr> </tbody> </table>								FINAL EVALUATION ONLY						<1%	0	0	0	<1%	<1%	9	10	10	10	9	9
FINAL EVALUATION ONLY																									
<1%	0	0	0	<1%	<1%																				
9	10	10	10	9	9																				

PANEL EVALUATION		CARBOMASTIC 15LO									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 8/9/93											
EVALUATION HOURS: 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER	55	56	57	58	59	60	COMMENTS				
ASTM D610 RUST GRADE	0.10%	0	0	0.03%	0.10%	0.10%					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	8	8					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	Few	Few					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY										
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY										
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%					
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9					

AL55-60.XLS

PANEL EVALUATION		CARBOMASTIC 15LO					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 9/6/93							
EVALUATION HOURS: 4032-Final							
COATING EVALUATION DATA							
TEST PANEL NUMBER	55	56	57	58	59	60	COMMENTS
ASTM D610 RUST GRADE	0.10%	0	0	0.03%	0.10%	0.10%	Blistering has occurred only along the scribe edges.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	6	4	4	4	6	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	Few	Few	Med	Med	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	0	1/64"	1/64"	1/64"	1/32"	1/64"	Loss of adhesion and underfilm rust creepage from scribe has occurred only under blisters.
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	10	9	9	9	8	9	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME			
RH			
TEMPERATURE			
SUBSTRATE CONDITION			
COATING BATCH NUMBERS			
THINNING			
EQUIPMENT			
NUMBER OF COATS			
SAG INDEX			
1st COAT			
3/11/93 @ 1:00 P.M.			
52%			
72F			
SSPC VIS 1-C @ 2-2.5 MILS PROFILE			
A: 2K3751M / B: 2H3301M			
#2 @ 25%			
DEVILBISS MBC 704E			
1ST COAT			
20 MILS			
2nd COAT			
3/12/93 @ 1:00 P.M.			
61%			
75F			
CARBOMASTIC 90 ALUMINUM			
A: 2K3751M / B: 2H3301M			
#2 @ 25%			
DEVILBISS MBC 704E			
2ND COAT			
20 MILS			
1st COAT			
5.2			
5.1			
4.48			
5.2			
5.8			
5.4			
2nd COAT			
6			
6.2			
5.4			
5			
6.8			
6.4			
TOTAL			
11.2			
11.3			
9.88			
10.2			
12.6			
11.8			
DRY FILM THICKNESS, MILS			
SAMPLE 61			
SAMPLE 62			
SAMPLE 63			
SAMPLE 64			
SAMPLE 65			
SAMPLE 66			

AL61-66.XLS

PANEL EVALUATION		CARBOMASTIC 90 ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/5/93								
EVALUATION HOURS: 336								
COATING EVALUATION DATA								
TEST PANEL NUMBER	61	62	63	64	65	66	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels in this set after 336 hours of exposure.	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

AL61-66.XLS

PANEL EVALUATION		CARBOMASTIC 90 ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/19/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER	61	62	63	64	65	66	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0.03%	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	<1%	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	9	10		

AL61-66.XLS

PANEL EVALUATION		CARBOMASTIC 90 ALUMINUM																																									
CLIENT: U.S. Army Corp of Eng.																																											
ALUMINUM/EPOXY MASTIC PROGRAM																																											
DATE: 5/17/93																																											
EVALUATION HOURS: 1344																																											
COATING EVALUATION DATA																																											
TEST PANEL NUMBER	61	62	63	64	65	66	COMMENTS																																				
ASTM D610 RUST GRADE	0	0	0	0	0.10%	0																																					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																																					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																																					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																																											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																																											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER																																											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																																											
TABLE 2, RATING # OF UNSCRIBED AREAS																																											
<table border="1"> <thead> <tr> <th colspan="6">FINAL EVALUATION ONLY</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="6">FINAL EVALUATION ONLY</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td><1%</td> <td>0</td> </tr> <tr> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>9</td> <td>10</td> </tr> </tbody> </table>								FINAL EVALUATION ONLY												FINAL EVALUATION ONLY												0	0	0	0	<1%	0	10	10	10	10	9	10
FINAL EVALUATION ONLY																																											
FINAL EVALUATION ONLY																																											
0	0	0	0	<1%	0																																						
10	10	10	10	9	10																																						

PANEL EVALUATION		CARBOMASTIC 90 ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 6/14/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER	61	62	63	64	65	66	COMMENTS	
ASTM D610 RUST GRADE	0	0.03%	0	0.03%	0.10%	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	0	<1%	<1%	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	10	9	9	10		

AL61-66.XLS

PANEL EVALUATION		CARBOMASTIC 90 ALUMINUM																											
CLIENT: U.S. Army Corp of Eng.																													
ALUMINUM/EPOXY MASTIC PROGRAM																													
DATE: 7/12/93																													
EVALUATION HOURS: 2688																													
COATING EVALUATION DATA																													
TEST PANEL NUMBER	61	62	63	64	65	66	COMMENTS																						
ASTM D610 RUST GRADE	0	0.10%	0.03%	0.10%	0.10%	0																							
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																													
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																													
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TABLE 2, RATING # OF UNSCRIBED AREAS																													
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FINAL EVALUATION ONLY																													
0	<1%	<1%	<1%	<1%	0																								
10	9	9	9	9	9	10																							

AL61-66.XLS

CARBOMASTIC 90 ALUMINUM

PANEL EVALUATION

CLIENT: U.S. Army Corp of Eng.
 ALUMINUM/EPOXY MASTIC PROGRAM
 DATE: 8/9/93
 EVALUATION HOURS: 3360

COATING EVALUATION DATA

TEST PANEL NUMBER
 ASTM D610 RUST GRADE
 ASTM D714 DEGREE OF BLISTERING, SIZE
 ASTM D714 DEGREE OF BLISTERING, FREQUENCY

ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS

MEANS CREEPAGE FROM SCRIBE,
 TABLE 1, INCHES

MEAN CREEPAGE FROM SCRIBE,
 TABLE 1, RATING NUMBER

RATING OF UNSCRIBED AREAS,
 TABLE 2, % FAILED

TABLE 2, RATING # OF UNSCRIBED AREAS

COMMENTS

61	62	63	64	65	66
0	0.10%	0.03%	0.10%	0.10%	0
0	0	0	0	0	0
0	0	0	0	0	0

FINAL EVALUATION ONLY

FINAL EVALUATION ONLY

0	<1%	<1%	<1%	<1%	0
10	9	9	9	9	10

AL61-66.XLS

PANEL EVALUATION		CARBOMASTIC 90 ALUMINUM									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/6/93											
EVALUATION HOURS: 4032-Final											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
61	62	63	64	65	66	COMMENTS					
0	0.10%	0.03%	0.10%	0.10%	0	Blistering has occurred only along scribe edges.					
8	8	8	0	0	0						
Few	Few	Few	0	0	0						
0	1/64"	1/64"	0	0	0	The only loss of adhesion and underfilm rusting from the scribe has occurred under blisters.					
10	9	9	10	10	10						
0	<1%	<1%	<1%	<1%	0						
10	9	9	9	9	10						

AL33-38B.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID	INDUSTRIAL ALUMINUM TT-P-38		
MANUFACTURER	DAVIS INDUSTRIAL COATING		
VOLUME % SOLIDS	NOT AVAILABLE		
VOC	NOT AVAILABLE		
POT LIFE	NOT AVAILABLE		
INDUCTION TIME	NOT AVAILABLE		
DRYING TIME MINIMUM	NOT AVAILABLE		
RECOMMENDED FILM THICKNESS	NOT AVAILABLE		
MIXING RATIOS	NOT AVAILABLE		
THINNING	SINGLE COMPONENT		
T-120 SPRAYING THINNER			
APPLICATION DATA			
DATE/TIME	1ST COAT	2ND COAT	3RD COAT
RH	3/11/93 @ 9:00 AM	3/12/93 @ 2:00 PM	3/13/93 @ 2:00 PM
TEMPERATURE	61%	55%	60%
SUBSTRATE CONDITION	75F	70F	71F
COATING BATCH NUMBERS	SSPC VIS1-C@2 MILS	SSPC SP5 RED OXIDE	TT-P-2-38 Aluminum
THINNING	07172139, LOT 793	UHA10993C	UHA10993C
EQUIPMENT	NONE	NONE	NONE
NUMBER OF COATS	BINKS CONVENTIONAL	BINKS CONVENTIONAL	BINKS CONVENTIONAL
SAG INDEX	1	1ST	2ND
	4 MILS	3 MILS	3 MILS
DRY FILM THICKNESS, MILS			
SAMPLE 33	2	1.3	1.9
SAMPLE 34	2.4	1.1	2.4
SAMPLE 35	2.1	1.3	2
SAMPLE 36	2.5	1.4	2.2
SAMPLE 37 B*	2.2	1.6	1.9
SAMPLE 38 B	2.2	1.2	2.1
	1st COAT	2nd COAT	3rd COAT
	TOTAL	TOTAL	TOTAL
	5.2	5.9	5.4
	6.1	5.7	5.5

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38							
CLIENT: U.S. Army Corp of Eng.									
ALUMINUM/EPOXY MASTIC PROGRAM									
DATE: 4/5/93									
EVALUATION HOURS: 336									
COATING EVALUATION DATA									
TEST PANEL NUMBER									
ASTM D610 RUST GRADE									
ASTM D714 DEGREE OF BLISTERING, SIZE									
ASTM D714 DEGREE OF BLISTERING, FREQUENCY									
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER									
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED									
TABLE 2, RATING # OF UNSCRIBED AREAS									
COMMENTS									
33	34	35	36	37B	38B				
0	0	0	0	0	0	There is no visible changes on any panels in this set after 336 hours of exposure.			
0	0	0	0	0	0				
0	0	0	0	0	0				
FINAL EVALUATION ONLY									
FINAL EVALUATION ONLY									
0	0	0	0	0	0				
10	10	10	10	10	10				

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/19/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER	33	34	35	36	37B	38B	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9		

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38																																																													
CLIENT: U.S. Army Corp of Eng. ALUMINUM/EPOXY MASTIC PROGRAM DATE: 5/17/93 EVALUATION HOURS: 1344																																																															
COATING EVALUATION DATA																																																															
TEST PANEL NUMBER	33	34	35	36	37B	38B	COMMENTS																																																								
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%																																																									
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																																																									
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																																																									
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																																																															
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TABLE 2, RATING # OF UNSCRIBED AREAS																																																															
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9	9	9	9	9	9	9	9																																																								

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 6/14/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER	33	34	35	36	37B	38B	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	There are no visible changes on any panels in this set since previous (1344 hr.) evaluation.	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	FINAL EVALUATION ONLY							
TABLE 2, RATING # OF UNSCRIBED AREAS	<1%	<1%	<1%	<1%	<1%	<1%		
	9	9	9	9	9	9		

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38																											
CLIENT: U.S. Army Corp of Eng.																													
ALUMINUM/EPOXY MASTIC PROGRAM																													
DATE: 7/12/93																													
EVALUATION HOURS: 2688																													
COATING EVALUATION DATA																													
TEST PANEL NUMBER	33	34	35	36	37B	38B	COMMENTS																						
ASTM D610 RUST GRADE	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%																							
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																													
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																													
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RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																													
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FINAL EVALUATION ONLY																													
<1%	<1%	<1%	<1%	<1%	<1%	<1%																							
9	9	9	9	9	9	9																							

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 8/9/93								
EVALUATION HOURS: 3360								
COATING EVALUATION DATA								
TEST PANEL NUMBER	33	34	35	36	37B	38B	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0.10%	0.10%	0.03%	0.03%	0.03%	Blistering has occurred only along the edges of the scribe.	
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	8	8	6		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Med	Dense	Med	Few		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9		

AL33-38B.XLS

PANEL EVALUATION		SSPC 25 / TT-P-38									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/6/93											
EVALUATION HOURS: 4032-Final											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
COMMENTS											
33	34	35	36	37B	38B						
0.03%	0.10%	0.10%	0.03%	0.03%	0.03%	All blistering occurred along scribe edges.					
8	8	8	8	8	8						
Few	Few	Med	Dense	Med	Few						
IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	IC/Steel	
>5/8	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/84	5/8 + 1/44	
0	10	0	9	0	9	0	9	0	7	0	9
Blistering along scribe edges was between primer and top coat. Loss of adhesion between primer and steel as well as under film rust creepage was very minimal.											
<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	
9	9	9	9	9	9	9	9	9	9	10	

AL19-24.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME			
RH			
TEMPERATURE			
SUBSTRATE CONDITION			
COATING BATCH NUMBERS			
THINNING			
EQUIPMENT			
NUMBER OF COATS			
SAG INDEX			
1st COAT			
3/12/93 @ 10:00 A.M.			
61%			
75f			
SSPC V15 1-C @ 2.0 MILS PROFILE			
A: N210202 / B: N210161			
T-4 @ 10%			
DEVILBISS MBC 704E			
1ST COAT			
> 22 MILS			
2nd COAT			
3/13/93 9:00 A.M.			
59%			
71F			
BAR RUST 239			
A: N210202 / B: N210161			
T-4 @ 10%			
DEVILBISS MBC 704E			
2ND COAT			
> 22 MILS			
1st COAT			
5.5			
7			
5.5			
6.6			
7.6			
5.1			
2nd COAT			
7.4			
8.4			
8.8			
11.1			
8.2			
5.4			
TOTAL			
12.9			
15.4			
14.3			
17.7			
15.8			
10.5			
DRY FILM THICKNESS, MILS			
SAMPLE 19			
SAMPLE 20			
SAMPLE 21			
SAMPLE 22			
SAMPLE 23			
SAMPLE 24			

AL19-24.XLS

PANEL EVALUATION		BAR RUST 239 EPOXY ALUMINUM MASTIC						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/5/93								
EVALUATION HOURS: 336								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
19	20	21	22	23	24	COMMENTS		
0	0	0	0	0	0	There are no visible changes on any panels in this set after 336 hours of exposure.		
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
10	10	10	10	10	10			

AL19-24.XLS

PANEL EVALUATION		BAR RUST 239 EPOXY ALUMINUM MASTIC						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/19/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER		19	20	21	22	23	24	COMMENTS
ASTM D610 RUST GRADE		0	0.03%	0.03%	0.03%	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE		0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY		0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE,								
TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE,								
TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS,								
TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
		FINAL EVALUATION ONLY						
		FINAL EVALUATION ONLY						
		0	<1%	<1%	<1%	0	0	
		10	9	9	9	10	10	

AL19-24.XLS

PANEL EVALUATION		BAR RUST 239 EPOXY ALUMINUM MASTIC						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 5/17/93								
EVALUATION HOURS: 1344								
COATING EVALUATION DATA								
TEST PANEL NUMBER	19	20	21	22	23	24	COMMENTS	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0.03%	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
	10	9	9	9	9	9	10	

AL19-24.XLS

PANEL EVALUATION		BAR RUST 239 EPOXY ALUMINUM MASTIC						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 6/14/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER	19	20	21	22	23	24	COMMENTS	
ASTM D610 RUST GRADE	0	0.03%	0.03%	0.03%	0.03%	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	<1%	<1%	<1%	<1%	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	9	9	9	9	10		

AL19-24.XLS

PANEL EVALUATION		BAR RUST 239 EPOXY ALUMINUM MASTIC						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
COMMENTS								
19	20	21	22	23	24			
0	0.03%	0.03%	0.03%	0.03%	0			
0	0	0	0	0	0			
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	<1%	<1%	<1%	<1%	0			
10	9	9	9	9	9			

PANEL EVALUATION		BAR RUST 239 EPOXY ALUMINUM MASTIC									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 4032-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
19	20	21	22	23	24	COMMENTS					
0	0.03%	0.03%	0.03%	0.03%	0	Blistering has occurred only along the scribe edges					
8	8	4	6	8	8	on this set of panels.					
Few	Few	Medium	Few	Few	Few						
> 1/16"	1/16"	< 1/8"	1/8"	< 1/16"	1/64	Loss of adhesion and underfilm rust creepage					
6	7	6	6	7	9	from scribe has occurred under blisters.					
0	< 1%	< 1%	< 1%	< 1%	0						
10	9	9	9	9	10						

AL72-77.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID	HEMPADUR 4515-1987		
MANUFACTURER	HEMPEL		
VOLUME % SOLIDS	82%		
VOC	1.5 LB/GAL (180 G/L)		
POT LIFE	3 HOURS @ 68F		
INDUCTION TIME	NONE		
DRYING TIME MINIMUM	RECOAT 8 HOURS @ 68F / FULL CURE 7 DAYS @ 68F		
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 8 / WET 10		
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME		
THINNING	#0846 THINNER @ 5% MAXIMUM		
APPLICATION DATA			
DATE/TIME	1st COAT	2nd COAT	
RH	3/12/93 @ 3:00 P.M.	3/13/93 @ 8:00 A.M.	
TEMPERATURE	55%	59%	
SUBSTRATE CONDITION	70F	71F	
COATING BATCH NUMBERS	SSPC VIS 1-C @ 2.0 MILS PROFILE	HEMPADUR 4515/1987 (1ST COAT)	
THINNING	A: UH2820323 / B: UH1030166	A: UH2820323 / B: UH1030166	
EQUIPMENT	#0846 @ 5%	#0846 @ 5%	
NUMBER OF COATS	DEVILBISS MBC 704E	DEVILBISS MBC 704E	
SAG INDEX	1	1	
	14 MILS	14 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 72	1st COAT	2nd COAT	TOTAL
SAMPLE 73	8	9	17
SAMPLE 74	7.5	7.9	15.4
SAMPLE 75	8	9.2	17.2
SAMPLE 76	7	9.3	16.3
SAMPLE 77	8.5	7.5	16
	8	9	17

PANEL EVALUATION		HEMPADUR 4515/1987						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/5/93								
EVALUATION HOURS: 336								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
72	73	74	75	76	77	COMMENTS		
0	0	0	0	0	0	There are no visible changes on any panels in this set after 336 hours of exposure.		
0	0	0	0	0	0			
0	0	0	0	0	0			
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
10	10	10	10	10	10			

AL72-77.XLS

PANEL EVALUATION		HEMPADUR 4515/1987					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 4/19/93							
EVALUATION HOURS: 672							
COATING EVALUATION DATA							
TEST PANEL NUMBER	72	73	74	75	76	77	COMMENTS
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	in this set after 672 hours of exposure
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

PANEL EVALUATION		HEMPADUR 4515/1987										
CLIENT: U.S. Army Corp of Eng.												
ALUMINUM/EPOXY MASTIC PROGRAM												
DATE: 5/17/93												
EVALUATION HOURS: 1344												
COATING EVALUATION DATA												
TEST PANEL NUMBER	72	73	74	75	76	77	COMMENTS					
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible changes on any panels					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	in this set after 1344 hours of exposure.					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0						
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS												
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0						
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10						

PANEL EVALUATION

HEMPADUR 4515/1987

CLIENT: U.S. Army Corp of Eng.

ALUMINUM/EPOXY MASTIC PROGRAM

DATE: 6/14/93

EVALUATION HOURS: 2016

COATING EVALUATION DATA

TEST PANEL NUMBER

ASTM D610 RUST GRADE

ASTM D714 DEGREE OF BLISTERING, SIZE

ASTM D714 DEGREE OF BLISTERING, FREQUENCY

ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS

MEAN CREEPAGE FROM SCRIBE,
TABLE 1, INCHES

MEAN CREEPAGE FROM SCRIBE,
TABLE 1, RATING NUMBER

**RATING OF UNSCRIBED AREAS,
TABLE 2, % FAILED**

TABLE 2. RATING # OF UNSCRIBED AREAS

COMMENTS					

PANEL EVALUATION		HEMPADUR 4515/1987						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER	72	73	74	75	76	77	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	2	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

AL72-77.XLS

PANEL EVALUATION		HEMPADUR 4515/1987						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 8/9/93								
EVALUATION HOURS: 3360								
COATING EVALUATION DATA								
TEST PANEL NUMBER	72	73	74	75	76	77	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only at the edge of the scribe.	
ASTM D714 DEGREE OF BLISTERING, SIZE	6	2	6	6	4	6		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	Med.	Few	Few		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

AL72-77.XLS

PANEL EVALUATION		HEMPADUR 4515/1987									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/6/93											
EVALUATION HOURS: 4032-Final											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
72	73	74	75	76	77	COMMENTS					
0	0	0	0	0	0	Blistering has occurred only along the scribe edges.					
2	2	4	2	2	2						
Few	Dense	Med	Med.	Med	Med-Den						
1/16"	1/8"	> 1/16"	1/8"	> 1/8"	1/8"	Loss of adhesion and underfilm rusting has occurred only under blisters.					
7	6	6	6	5	6						
0	0	0	0	0	0						
10	10	10	10	10	10						

AL49-54.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME			
RH			
TEMPERATURE			
SUBSTRATE CONDITION			
COATING BATCH NUMBERS			
THINNING			
EQUIPMENT			
NUMBER OF COATS			
SAG INDEX			
DRY FILM THICKNESS, MILS			
SAMPLE 49			
SAMPLE 50			
SAMPLE 51			
SAMPLE 52			
SAMPLE 53			
SAMPLE 54			
INTERGARD UNIVERSAL ALUMINUM			
PORTER INTERNATIONAL			
80% +/- 2%			
1.60 LB/GAL (192 G/L)			
4 HOURS @ 75F			
15 MINS @ 75F			
RECOAT 6 HOURS @ 75F / FULL CURE NOT STATED			
MILS PER COAT : DRY 4-8 / WET 6.3-10.0			
1 PART A : 1 PART B BY VOLUME			
#T-5 THINNER @ 12% MAXIMUM			
1st COAT		2nd COAT	
3/10/93 @ 4:00 P.M.		N/A	
63%		N/A	
73F		N/A	
SSPC VIS 1.C @ 2.2 MILS PROFILE		N/A	
A: UHA 10055B / B: UHN 12602M		N/A	
#T-5 @ 12%		N/A	
DEVILBISS MBC 704E		N/A	
1		N/A	
> 24 MILS / 7 MILS THINNED 12%		N/A	
1st COAT		2nd COAT	
7.3		N/A	
6.9		N/A	
7.8		N/A	
6.7		N/A	
7.1		N/A	
8		N/A	
TOTAL		TOTAL	
7.3		7.3	
6.9		6.9	
7.8		7.8	
6.7		6.7	
7.1		7.1	
8		8	

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/5/93								
EVALUATION HOURS: 336								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
49	50	51	52	53	54	COMMENTS		
0	0	0	0	0	0	There are no visible effects on any panels in this set after 336 hours of exposure.		
0	0	0	0	0	0			
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	0	0	0	0	0			
10	10	10	10	10	10			

AL49-54.XLS

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM																				
CLIENT: U.S. Army Corp of Eng.																						
ALUMINUM/EPOXY MASTIC PROGRAM																						
DATE: 4/19/93																						
EVALUATION HOURS: 672																						
COATING EVALUATION DATA																						
TEST PANEL NUMBER	49	50	51	52	53	54	COMMENTS															
ASTM D610 RUST GRADE	0	0	0	0	0	0.03%																
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																
ASTM D 1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER																						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																						
TABLE 2, RATING # OF UNSCRIBED AREAS																						
<table border="1"> <thead> <tr> <th colspan="7">FINAL EVALUATION ONLY</th> </tr> </thead> <tbody> <tr> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>9</td> </tr> </tbody> </table>									FINAL EVALUATION ONLY							10	10	10	10	10	10	9
FINAL EVALUATION ONLY																						
10	10	10	10	10	10	9																

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 5/17/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER	49	50	51	52	53	54	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0.03%					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY										
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY										
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	<1%					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	9					

AL49-54.XLS

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 6/14/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
49	50	51	52	53	54	COMMENTS		
0	0	0.03%	0	0	0.03%			
0	0	0	0	0	0			
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	0	<1%	0	0	<1%			
10	10	9	10	10	9			

AL49-54.XLS

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
49	50	51	52	53	54	COMMENTS		
0	0	0.03%	0	0	0.03%			
0	0	0	0	0	0			
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	0	<1%	0	0	<1%			
10	10	9	10	10	9			

AL49-54.XLS

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM																			
CLIENT: U.S. Army Corp of Eng.																					
ALUMINUM/EPOXY MASTIC PROGRAM																					
DATE: 8/9/93																					
EVALUATION HOURS: 3360																					
COATING EVALUATION DATA																					
TEST PANEL NUMBER																					
ASTM D610 RUST GRADE																					
ASTM D714 DEGREE OF BLISTERING, SIZE																					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY																					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																					
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																					
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER																					
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																					
TABLE 2, RATING # OF UNSCRIBED AREAS																					
<table border="1"> <thead> <tr> <th colspan="2">COMMENTS</th> </tr> </thead> <tbody> <tr> <td>49</td> <td>50 51 52 53 54</td> </tr> <tr> <td>0.03%</td> <td>0 0.03% 0.03% 0 0.03% Blistering has occurred only at the edge of the</td> </tr> <tr> <td>8</td> <td>8 8 8 8 8 scribe.</td> </tr> <tr> <td>Few</td> <td>Few Few Few Few Few</td> </tr> </tbody> </table>												COMMENTS		49	50 51 52 53 54	0.03%	0 0.03% 0.03% 0 0.03% Blistering has occurred only at the edge of the	8	8 8 8 8 8 scribe.	Few	Few Few Few Few Few
COMMENTS																					
49	50 51 52 53 54																				
0.03%	0 0.03% 0.03% 0 0.03% Blistering has occurred only at the edge of the																				
8	8 8 8 8 8 scribe.																				
Few	Few Few Few Few Few																				
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FINAL EVALUATION ONLY																					
<1%	0 <1% <1% 0 <1%																				
9	10 9 9 10 9																				

AL49-54.XLS

PANEL EVALUATION		INTERGARD UNIVERSAL ALUMINUM									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 4032-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER	49	50	51	52	53	54					
ASTM D610 RUST GRADE	0.03%	0	0.03%	0.03%	0	0.03%	Blistering has occurred only along the scribe edges.				
ASTM D714 DEGREE OF BLISTERING, SIZE	8	4	8	6	8	8					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med/Den	Few	Med/Den	Med	Med					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/64"	1/16"	1/32"	>1/16"	1/64"	1/64"	Loss of adhesion and underfilm rust creepage from the scribe has occurred only under blisters.				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	9	7	8	6	9	9					
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	<1%	<1%	0	<1%					
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	9	9	10	10					

AL43-48.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME			
RH			
TEMPERATURE			
SUBSTRATE CONDITION			
COATING BATCH NUMBERS			
THINNING			
EQUIPMENT			
NUMBER OF COATS			
SAG INDEX			
DRY FILM THICKNESS, MILS			
SAMPLE 43			
SAMPLE 44			
SAMPLE 45			
SAMPLE 46			
SAMPLE 47			
SAMPLE 48			

MAGNA MASTIC 7900			
PORTER INTERNATIONAL			
84% +/- 2%			
1.01 LB/GAL (121 G/L)			
4 HOURS @ 75F			
15 MINS @ 75F			
RECOAT 24 HOURS @ 75F / FULL CURE NOT STATED			
MILS PER COAT : DRY 5 / WET 6			
1 PART A: 1 PART B BY VOLUME			
#T-5 THINNER @ 12% MAXIMUM			

1st COAT	2nd COAT
3/10/93 @ 3:00 P.M.	N/A
59%	N/A
72F	N/A
SSPC VIS 1-C @ 2.3 MILS PROFILE	N/A
A: 2213639 / B: 2213681	N/A
T-5 @ 12%	N/A
DEVILBISS MBC 704E	N/A
1	N/A
15 MILS THINNED 12%	N/A

1st COAT	2nd COAT	TOTAL
8	N/A	8
5.7	N/A	5.7
4.5	N/A	4.5
5.5	N/A	5.5
4.8	N/A	4.8
4.4	N/A	4.4

PANEL EVALUATION		MAGNA MASTIC 7900																																																																																																																			
CLIENT: U.S. Army Corp of Eng.																																																																																																																					
ALUMINUM/EPOXY MASTIC PROGRAM																																																																																																																					
DATE: 4/5/93																																																																																																																					
EVALUATION HOURS: 336																																																																																																																					
COATING EVALUATION DATA																																																																																																																					
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10	10	10	10	10	10	10	10	10	10																																																																																																												

AL43-48.XLS

PANEL EVALUATION		MAGNA MASTIC 7900							
CLIENT: U.S. Army Corp of Eng.									
ALUMINUM/EPOXY MASTIC PROGRAM									
DATE: 4/19/93									
EVALUATION HOURS: 672									
COATING EVALUATION DATA									
TEST PANEL NUMBER									
ASTM D610 RUST GRADE									
ASTM D714 DEGREE OF BLISTERING, SIZE									
ASTM D714 DEGREE OF BLISTERING, FREQUENCY									
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER									
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED									
TABLE 2, RATING # OF UNSCRIBED AREAS									
43	44	45	46	47	48				
0.03%	0.03%	0.10%	0.03%	0.03%	0.30%				
0	0	0	0	0	0				
0	0	0	0	0	0				
FINAL EVALUATION ONLY									
FINAL EVALUATION ONLY									
<1%	<1%	<1%	<1%	<1%	<1%				
9	9	9	9	9	9				

PANEL EVALUATION		MAGNA MASTIC 7900						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 5/17/93								
EVALUATION HOURS: 1344								
COATING EVALUATION DATA								
TEST PANEL NUMBER	43	44	45	46	47	48	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0.03%	0.10%	0.03%	0.03%	0.03%	There are no visible changes in this set of panels since previous (672 hours) evaluation.	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9		

AL43-48.XLS

PANEL EVALUATION		MAGNA MASTIC 7900						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 6/14/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
43	44	45	46	47	48			
0.10%	3.00%	10%	10%	5%	20%			
0	0	0	8	0	8			
0	0	0	0 Few	0	0 Few			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
<1%	3%	10%	10%	5%	20%			
9	8	6	6	7	5			

PANEL EVALUATION		MAGNA MASTIC 7900						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER	43	44	45	46	47	48	COMMENTS	
ASTM D610 RUST GRADE	10%	16%	50%	50%	10%	50%		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	8	8	8	0	8		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	Few	Med	0	Med		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	10%	16%	50%	50%	10%	50%		
TABLE 2, RATING # OF UNSCRIBED AREAS	6	5	2	2	6	2		

AL43-48.XLS

PANEL EVALUATION		MAGNA MASTIC 7900						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 8/9/93								
EVALUATION HOURS: 3360								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
43	44	45	46	47	48			
10%	40%	90%	90%	16%	95%			
8	8	8	8	8	8			
Few	Med	Med	Dense	Few	Dense			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
10%	40%	90%	90%	16%	95%			
9	3	0	0	5	0			

AL43-48.XLS

PANEL EVALUATION		MAGNA MASTIC 7900									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 4032-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
43	44	45	46	47	48						
10%	60%	90%	90%	32%	95%						
8	8	8	6	8	8						
Med.	Dense	Dense	Dense	Few	Dense						
1/64"	1/64"	1/64"	1/64"	1/64"	1/64"						
9	9	9	9	9	9						
10%	60%	90%	90%	32%	95%						
6	1	0	0	3	0						

AL1-6.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME			
RH			
TEMPERATURE			
SUBSTRATE CONDITION			
COATING BATCH NUMBERS			
THINNING			
EQUIPMENT			
NUMBER OF COATS			
SAG INDEX			
DRY FILM THICKNESS, MILS			
SAMPLE 1			
SAMPLE 2			
SAMPLE 3			
SAMPLE 4			
SAMPLE 5			
SAMPLE 6			
1st COAT		2nd COAT	
3/2/93 @ 8:00 A.M.		3/3/93 @ 3:00 P.M.	
63%		60%	
73F		73F	
SSPC VIS 1-C @ 2.0 MILS PROFILE		EPOXY MASTIC ALUMINUM II	
PART A T0992 / PART B T0992		A: T0692 B: T0992	
R2K4 XYLENE @ 10%		R2K4 XYLENE @ 10%	
DEVILBISS MCB 704E		DEVILBISS MCB 704e	
1		1	
14 MILS / 7 MILS THINNED		7 MILS THINNED 10%	
1st COAT		2nd COAT	
6.6		5.9	
6.7		4.7	
6.8		5.2	
6.8		5.2	
6.7		5.8	
7.2		4.9	
TOTAL		TOTAL	
12.5		12.5	
11.4		11.4	
12		12	
12		12	
12.5		12.5	
12.1		12.1	

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/5/93								
EVALUATION HOURS: 336								
COATING EVALUATION DATA								
TEST PANEL NUMBER	1	2	3	4	5	6	There is no visible effect from 336 hours of exposure on any of the panels in this set.	
ASTM D610 RUST GRADE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

AL1-6.XLS

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 4/19/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
1	2	3	4	5	6			
0.03%	0	0	0.03%	0.03%	0.03%			
0	0	0	0	0	0			
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
<1%	0	0	<1%	<1%	<1%			
9	10	10	9	9	9			
COMMENTS								

AL1-6.XLS

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 5/17/93							
EVALUATION HOURS: 1344							
COATING EVALUATION DATA							
TEST PANEL NUMBER							
ASTM D610 RUST GRADE							
ASTM D714 DEGREE OF BLISTERING, SIZE							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED							
TABLE 2, RATING # OF UNSCRIBED AREAS							
1	2	3	4	5	6		
0.03%	0	0	0.03%	0.03%	0.03%		
0	0	0	0	0	0		
0	0	0	0	0	0		
FINAL EVALUATION ONLY							
FINAL EVALUATION ONLY							
<1%	0	0	<1%	<1%	<1%		
9	10	10	9	9	9		

AL11-6.XLS

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 6/14/93							
EVALUATION HOURS: 2016							
COATING EVALUATION DATA							
TEST PANEL NUMBER	1	2	3	4	5	6	COMMENTS
ASTM D610 RUST GRADE	0.03%	0	0	0.03%	0.03%	0.03%	There have been no noticeable changes in any of these panels since the previous (1344 hour) evaluation.
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	<1%	<1%	
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	9	9	

AL1-6.XLS

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
1	2	3	4	5	6	COMMENTS		
0.03%	0.03%	0.03%	0.03%	0.03%	0.03%			
0	0	0	0	0	0			
0	0	0	0	0	0			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
<1%	<1%	<1%	<1%	<1%	<1%			
9	9	9	9	9	9			

AL1-6.XLS

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 8/9/93							
EVALUATION HOURS: 3360							
COATING EVALUATION DATA							
TEST PANEL NUMBER							
ASTM D610 RUST GRADE							
ASTM D714 DEGREE OF BLISTERING, SIZE							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED							
TABLE 2, RATING # OF UNSCRIBED AREAS							
1	2	3	4	5	6	COMMENTS	
0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	There are no visible changes in any panels in this set since the previous (2688 hr) evaluation.	
0	0	0	0	0	0		
0	0	0	0	0	0		
FINAL EVALUATION ONLY							
FINAL EVALUATION ONLY							
<1%	<1%	<1%	<1%	<1%	<1%		
9	9	9	9	9	9		

PANEL EVALUATION		EPOXY MASTIC ALUMINUM II						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 9/13/93								
EVALUATION HOURS: 4032-Final								
COATING EVALUATION DATA								
TEST PANEL NUMBER	1	2	3	4	5	6	COMMENTS	
ASTM D610 RUST GRADE	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAS CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/16"	3/32"	>1/16"	<1/16"	>1/16"	>1/16"		
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	7	6	6	7	6	6		
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	<1%	<1%	<1%	<1%	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9	9	9	9	9	9		

AL7-12.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID			
MANUFACTURER			
VOLUME % SOLIDS			
VOC			
POT LIFE			
INDUCTION TIME			
DRYING TIME MINIMUM			
RECOMMENDED FILM THICKNESS			
MIXING RATIOS			
THINNING			
APPLICATION DATA			
DATE/TIME		1st COAT	2nd COAT
RH		3/2/93 @ 1:00 P.M.	3/3/93 21:00 P.M.
TEMPERATURE		57%	60%
SUBSTRATE CONDITION		72F	73F
COATING BATCH NUMBERS		SSPC VIS 1-C @ 2.4 MILS PROFILE	MACROPOXY ALUMINUM (1ST COAT)
THINNING		A: 38-1991010140-1017/B: 38-199120522164	A: 38-1991010140-1017/B: 38-199120522164
EQUIPMENT		XYLENE @ 5%	XYLENE 5%
NUMBER OF COATS		BINKS	BINKS
SAG INDEX		1	1
		9 MILS / 7 MILS THINNED 5%	7 MILS THINNED 5%
DRY FILM THICKNESS, MILS			
SAMPLE 7	6	1st COAT	2nd COAT
SAMPLE 8	5.8		4.5
SAMPLE 9	5.7		4.5
SAMPLE 10	6.2		3.5
SAMPLE 11	6.8		4.3
SAMPLE 12	7.3		4.1
			3.4
			TOTAL
			10.5
			10.3
			9.2
			10.5
			10.9
			10.7

AL7-12.XLS

PANEL EVALUATION		MACROPOXY ALUMINUM																																									
CLIENT: U.S. Army Corp of Eng.																																											
ALUMINUM/EPOXY MASTIC PROGRAM																																											
DATE: 4/5/93																																											
EVALUATION HOURS: 336																																											
COATING EVALUATION DATA																																											
TEST PANEL NUMBER																																											
ASTM D610 RUST GRADE																																											
ASTM D714 DEGREE OF BLISTERING, SIZE																																											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY																																											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																																											
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	7	8	9	10	11	12	COMMENTS																																				
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AL7-12.XLS

PANEL EVALUATION		MACROPOXY ALUMINUM				
CLIENT: U.S. Army Corp of Eng. ALUMINUM/EPOXY MASTIC PROGRAM DATE: 4/19/93 EVALUATION HOURS: 672						
COATING EVALUATION DATA						
TEST PANEL NUMBER						
ASTM D610 RUST GRADE						
ASTM D714 DEGREE OF BLISTERING, SIZE						
ASTM D714 DEGREE OF BLISTERING, FREQUENCY						
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES						
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TABLE 2, RATING # OF UNSCRIBED AREAS						

MACROPOXY ALUMINUM						
CLIENT: U.S. Army Corp of Eng. ALUMINUM/EPOXY MASTIC PROGRAM DATE: 4/19/93 EVALUATION HOURS: 672						
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ASTM D610 RUST GRADE						
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MACROPOXY ALUMINUM						
CLIENT: U.S. Army Corp of Eng. ALUMINUM/EPOXY MASTIC PROGRAM DATE: 4/19/93 EVALUATION HOURS: 672						
COATING EVALUATION DATA						
TEST PANEL NUMBER						
ASTM D610 RUST GRADE						
ASTM D714 DEGREE OF BLISTERING, SIZE						
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RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED						
TABLE 2, RATING # OF UNSCRIBED AREAS						

AL7-12.XLS

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PANEL EVALUATION		MACROPOXY ALUMINUM									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 7/12/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
7	8	9	10	11	12						
0	0	0	0	0	0						
0	0	0	0	0	0						
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						
COMMENTS											

AL7-12.XLS

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0	0	0	0	0	0	0																																													
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AL7-12.XLS

PANEL EVALUATION

CLIENT: U.S. Army Corp of Eng.
 ALUMINUM/EPOXY MASTIC PROGRAM
 DATE: 9/13/93
 EVALUATION HOURS: 4032-FINAL

COATING EVALUATION DATA

TEST PANEL NUMBER
 ASTM D610 RUST GRADE
 ASTM D714 DEGREE OF BLISTERING, SIZE
 ASTM D714 DEGREE OF BLISTERING, FREQUENCY

ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS

MEAN CREEPAGE FROM SCRIBE,
 TABLE 1, INCHES

MEAN CREEPAGE FROM SCRIBE,
 TABLE 1, RATING NUMBER

RATING OF UNSCRIBED AREAS,
 TABLE 2, % FAILED

TABLE 2, RATING # OF UNSCRIBED AREAS

MACROPOXY ALUMINUM

COMMENTS					

AL13-18.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID	SURFACE TOLERANT EPOXY COATING		
MANUFACTURER	SHERWIN-WILLIAMS		
VOLUME % SOLIDS	80% +/- 2%		
VOC	1.45 LB/GAS (174 G/L)		
POT LIFE	4 HOUR @ 77F		
INDUCTION TIME	15 MIN @ 77F		
DRYING TIME MINIMUM	RECOAT 18 HOURS @ 77f / FULL CURE 10 DAY @ 77F		
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 6 / WET 7		
MIXING RATIOS	4 PARTS A : 1 PART B BY VOLUME		
THINNING	R2K4 XYLENE @ 10% MAXIMUM		
APPLICATION DATA			
DATE/TIME	1st COAT	2nd COAT	
RH	3/2/93 @ 9:00 A.M.	3/13/93 @ 4:30 P.M.	
TEMPERATURE	63%	59%	
SUBSTRATE CONDITION	74F	72F	
COATING BATCH NUMBERS	SSPC VIS 1-C @ 2.5 MILS PROFILE	SURFACE TOL EPOXY COATING (1ST COAT)	
THINNING	A: T2211/B: T2340	A: T2211 / B: T2340	
EQUIPMENT	R2K4 XYLENE @ 10%	R2K4 XYLENE 10%	
NUMBER OF COATS	DEVILBISS MCB 704e	DEVILBISS MCB 704e	
SAG INDEX	1	1	
	15 MILS / 7 MILS THINNED	7 MILS THINNED 10%	
DRY FILM THICKNESS, MILS			
SAMPLE 13	1st COAT	2nd COAT	TOTAL
SAMPLE 14	5.5	5.5	11
SAMPLE 15	6.9	5.3	12.2
SAMPLE 16	5.9	5.7	11.6
SAMPLE 17	5.5	4.2	9.7
SAMPLE 18	5.5	5.8	11.3
	6.8	6.4	13.2

PANEL EVALUATION		SURFACE TOLERANT EPOXY									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 4/5/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects on any panels in this set				
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 336 hours of exposure.				
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY										
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY										
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

AL13-18.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 4/19/93											
EVALUATION HOURS: 672											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
13	14	15	16	17	18	COMMENTS					
0	0	0	0	0.03%	0.03%						
0	0	0	0	0	0						
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	<1%	<1%						
10	10	10	10	9	9						

SURFACE TOLERANT EPOXY									
<div style="display: flex; justify-content: space-between;"> <div> <p>CLIENT: U.S. Army Corp of Eng.</p> <p>ALUMINUM/EPOXY MASTIC PROGRAM</p> <p>DATE: 5/17/93</p> <p>EVALUATION HOURS: 1344</p> </div> </div>									
<div style="display: flex; justify-content: space-between;"> <div> <p>TEST PANEL NUMBER</p> <p>ASTM D610 RUST GRADE</p> <p>ASTM D714 DEGREE OF BLISTERING, SIZE</p> <p>ASTM D714 DEGREE OF BLISTERING, FREQUENCY</p> </div> </div>									
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<div style="display: flex; justify-content: space-between;"> <div> <p>13</p> <p>0.03%</p> <p>0</p> <p>0</p> </div> <div> <p>14</p> <p>0</p> <p>0</p> <p>0</p> </div> <div> <p>15</p> <p>0</p> <p>0</p> <p>0</p> </div> <div> <p>16</p> <p>0</p> <p>0</p> <p>0</p> </div> <div> <p>17</p> <p>0.03%</p> <p>0</p> <p>0</p> </div> <div> <p>18</p> <p>0.03%</p> <p>0</p> <p>0</p> </div> </div>									
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AL13-18.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY						
CLIENT: U.S. Army Corp of Eng. ALUMINUM/EPOXY MASTIC PROGRAM DATE: 6/14/93 EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.035	No visible changes in this set of panels since previous (1344 hr.) evaluation.	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9		

PANEL EVALUATION		SURFACE TOLERANT EPOXY						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0	0	0	0.03%	0.03%		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE,								
TABLE 1, INCHES	FINAL EVALUATION ONLY							
MEAN CREEPAGE FROM SCRIBE,								
TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY							
RATING OF UNSCRIBED AREAS,								
TABLE 2, % FAILED	<1%	0	0	0	<1%	<1%		
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	10	9	9		

AL13-18.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 8/9/93											
EVALUATION HOURS 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
13	14	15	16	17	18	COMMENTS					
0.03%	0	0	0	0.03%	0.03%						
6	6	8	8	6	8	8 Blistering is occurring only at the edge of the scribe.					
Med.	Dense	Med.	Few	Few	Few						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
<1%	0	0	0	<1%	<1%						
9	10	10	10	9	9						

AL13-18.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 9/13/93								
EVALUATION HOURS 4032-FINAL								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
13	14	15	16	17	18	COMMENTS		
0.03%	0	0	0	0.03%	0.03%	Blistering has occurred only along the scribe edges.		
4	2	4	8	6	6			
Dense	Medium	Medium	Medium	Medium	Medium			
> 1/8"	> 1/8"	< 1/8"	< 1/8"	< 1/8"	1/16"	Loss of adhesion and underfilm rust creepage has occurred only under blisters along the scribe edges.		
5	5	6	6	6	7			
< 1%	0	0	0	< 1%	< 1%			
9	10	10	10	9	9			

AL37A-42.XLS

US ARMY CORP OF ENGINEERS		ALUMINUM EPOXY MASTIC PROGRAM	
COATING SYSTEM DATA			
COATING ID	COLTURIET TCP ALUMINUM		
MANUFACTURER	SIGMA COATINGS		
VOLUME % SOLIDS	80% +/-2%		
VOC	2.0 LB/GAL (239 g/L)		
POT LIFE	6 HOURS @ 68F		
INDUCTION TIME	NONE		
DRYING TIME MINIMUM	RECOAT 14 HOURS @ 68F / FULL CURE 5 DAYS @ 68F		
RECOMMENDED FILM THICKNESS	MILS PER COAT : DRY 5-8 / WET 6-9.6		
MIXING RATIOS	77 PARTS A: 23 PARTS B BY VOLUME		
THINNING	#91-92 THINNER @ 15% MAXIMUM		
APPLICATION DATA			
DATE/TIME	3/11/93 @ 8:00 A.M.		
RH	58%		
TEMPERATURE	70F		
SUBSTRATE CONDITION	SSPC VIS 1-C @ 2.0 MILS PROFILE		
COATING BATCH NUMBERS	A: 188052 / B: 069112		
THINNING	#91-92 @ 15%		
EQUIPMENT	DEVILBISS MBC 704E		
NUMBER OF COATS	1		
SAG INDEX	> 24 MILS / 16 MILS THINNED		
DRY FILM THICKNESS, MILS			
SAMPLE 37A	6.5		
SAMPLE 38A	5.5		
SAMPLE 39	6		
SAMPLE 40	5.5		
SAMPLE 41	6		
SAMPLE 42	5.7		
1st COAT			
3/11/93 @ 8:00 A.M.			
58%			
70F			
SSPC VIS 1-C @ 2.0 MILS PROFILE			
A: 188052 / B: 069112			
#91-92 @ 15%			
DEVILBISS MBC 704E			
1			
> 24 MILS / 16 MILS THINNED			
2nd COAT			
3/12/93 @ 11:00 A.M.			
61%			
75F			
COLTURIET TCP ALUMINUM			
A: 188052 / B: 069112			
#91-92 @ 15%			
DEVILBISS MBC 704E			
1			
16 MILS THINNED 15%			
TOTAL			
13			
11.8			
11.8			
11.8			
13.5			
12.3			

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 4/5/93							
EVALUATION HOURS: 336							
COATING EVALUATION DATA							
TEST PANEL NUMBER							
ASTM D610 RUST GRADE							
ASTM D714 DEGREE OF BLISTERING, SIZE							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED							
TABLE 2, RATING # OF UNSCRIBED AREAS							
37A	38A	39	40	41	42	COMMENTS	
0	0	0	0	0	0	There is no visible effect on any panel in this set after 336 hours of exposure.	
0	0	0	0	0	0		
0	0	0	0	0	0		
FINAL EVALUATION ONLY							
FINAL EVALUATION ONLY							
0	0	0	0	0	0		
10	10	10	10	10	10		

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM																																																
CLIENT: U.S. Army Corp of Eng. ALUMINUM/EPOXY MASTIC PROGRAM DATE: 4/19/93 EVALUATION HOURS: 672																																																		
COATING EVALUATION DATA																																																		
TEST PANEL NUMBER	37A	38A	39	40	41	42	COMMENTS																																											
ASTM D610 RUST GRADE	0.03%	0	0	0	0	0																																												
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																																												
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																																												
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FINAL EVALUATION ONLY																																																		
FINAL EVALUATION ONLY																																																		
<1%	0	0	0	0	0	0																																												
9	10	10	10	10	10	10																																												

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 5/17/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER	37A	38A	39	40	41	42	COMMENTS				
ASTM D610 RUST GRADE	0.03%	0	0	0.03%	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	FINAL EVALUATION ONLY										
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	FINAL EVALUATION ONLY										
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<1%	0	0	<1%	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	9	10	10	9	10	10					

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM																																		
CLIENT: U.S. Army Corp of Eng.																																				
ALUMINUM/EPOXY MASTIC PROGRAM																																				
DATE: 6/14/93																																				
EVALUATION HOURS: 2016																																				
COATING EVALUATION DATA																																				
TEST PANEL NUMBER	37A	38A	39	40	41	42	COMMENTS																													
ASTM D610 RUST GRADE	0.03%	0.03%	0	0.03%	0	0																														
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0																														
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																														
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<1%	<1%	0	<1%	0	0	0																														
9	9	10	9	10	10	10																														

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM						
CLIENT: U.S. Army Corp of Eng.								
ALUMINUM/EPOXY MASTIC PROGRAM								
DATE: 7/12/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER	37A	38A	39	40	41	42	COMMENTS	
ASTM D610 RUST GRADE	0.03%	0.03%	0	0.03%	0.03%	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE,								
TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE,								
TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS,								
TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM					
CLIENT: U.S. Army Corp of Eng.							
ALUMINUM/EPOXY MASTIC PROGRAM							
DATE: 8/9/93							
EVALUATION HOURS: 3360							
COATING EVALUATION DATA							
TEST PANEL NUMBER							
ASTM D610 RUST GRADE							
ASTM D714 DEGREE OF BLISTERING, SIZE							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED							
TABLE 2, RATING # OF UNSCRIBED AREAS							
37A	38A	39	40	41	42	COMMENTS	
0.03%	0.03%	0	0.03%	0.03%	0	Blistering has occurred only at the edges of the scribe.	
6	6	8	8	8	6		
Few	Few	Few	Few	Few	Few		
FINAL EVALUATION ONLY							
FINAL EVALUATION ONLY							
<1%	<1%	0	<1%	<1%	0		
9	9	10	9	9	10		

AL37A-42.XLS

PANEL EVALUATION		COLTURIET TCP ALUMINUM									
CLIENT: U.S. Army Corp of Eng.											
ALUMINUM/EPOXY MASTIC PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 4032-Final											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
37A	38A	39	40	41	42						
0.03%	0.03%	0	0.03%	0.03%	0						
2	2	4	8	6	4	Blistering has occurred only along the scribe edges.					
Med.	Med/Den	Med/Den	Few	Few	Med.						
> 1/16"	1/8"	1/16"	1/32"	1/32"	1/8"	Loss of adhesion and underfilm rusting has occurred only under blisters at scribe edges.					
6	6	7	8	8	6						
< 1%	< 1%	0	< 1%	< 1%	0						
9	9	10	9	9	10						

Appendix B: Epoxy/Urethane System Test Results

URE1-6.XLS

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	CARBOMASTIC 90	CARBOTHANE 134HS	
MANUFACTURER	CARBOLINE	CARBOLINE	
VOLUME % SOLIDS	90% +/- 2%	66% +/- 2%	
VOC	0.70 LB/GAL 984 G/L)	2.4 LB/GAL (288 G/L)	
POT LIFE	4 HOURS AT 75F	6 HOURS AT 75F	
INDUCTION TIME	NONE	NONE	
DRYING TIME MINIMUM TO RECOAT	12 HOURS AT 75F	8 HOURS AT 75F FULL CURE - 7 DAYS	
RECOMMENDED FILM THICKNESS, DRY	5 MILS PER COAT DRY	2-4 MILS DRY / 3-6 MILS WET	
MIXING RATIOS	1:1 BY VOLUME	8 PARTS A : 1 PART B BY VOLUME	
THINNING	CARBOLINE NO. 2	CARBOLINE NO. 214	
APPLICATION DATA			
DATE/TIME	4/8/93 @ 2:00 PM	4/13/93 @ 2:00 P.M.	
RH	55%	50%	
TEMPERATURE	73F	74F	
SUBSTRATE CONDITION	SSPC VIS. -1C	N/A	
COATING BATCH NUMBERS	A: 2K375M B: 2H3301M	A: 2F2797M B: 2K0112C	
THINNING	10% WITH NO. 2 THINNER	NONE	
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	
NUMBER OF COATS	1	1	
SAG INDEX	20 MILS	9 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 1	6.9 MILS	5.5 MILS	12.4 MILS
SAMPLE 2	5.4 MILS	5.3 MILS	10.7 MILS
SAMPLE 3	5.8 MILS	4.6 MILS	10.4 MILS
SAMPLE 4	5.6 MILS	4.3 MILS	9.9 MILS
SAMPLE 5	6.2 MILS	3.5 MILS	9.7 MILS
SAMPLE 6	6.4 MILS	4.8 MILS	11.2 MILS
		TOTAL	

URE1-6.XLS

PANEL EVALUATION		CARBOMASTIC 90 / CARBOTHANE 134HS							
CLIENT: U.S. ARMY CORPS OF ENG.									
EPOXY URETHANE PROGRAM									
DATE: 5/10/93									
EVALUATION HOURS: 336									
COATING EVALUATION DATA									
TEST PANEL NUMBER									
ASTM D610 RUST GRADE									
ASTM D714 DEGREE OF BLISTERING, SIZE									
ASTM D714 DEGREE OF BLISTERING, FREQUENCY									
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER									
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED									
TABLE 2, RATING # OF UNSCRIBED AREAS									
		1	2	3	4	5	6	COMMENTS There are no visible effects on any panels in this set after 336 hours of exposure.	
		0	0	0	0	0	0		
		0	0	0	0	0	0		
		0	0	0	0	0	0		
		FINAL EVALUATION ONLY							
		FINAL EVALUATION ONLY							
		0	0	0	0	0	0	0	
		10	10	10	10	10	10	10	

PANEL EVALUATION		CARBOMASTIC 90 / CARBOTHANE 134HS																													
CLIENT: U.S. ARMY CORPS OF ENG.																															
EPOXY URETHANE PROGRAM																															
DATE: 5/24/93																															
EVALUATION HOURS: 672																															
COATING EVALUATION DATA																															
TEST PANEL NUMBER	1	2	3	4	5	6	COMMENTS																								
ASTM D610 RUST GRADE	0	0	0	0	0	0	There are no visible effects on any panels in this set																								
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0	after 672 hours of exposure.																								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0																									
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																															
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																															
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER																															
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																															
TABLE 2, RATING # OF UNSCRIBED AREAS																															
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FINAL EVALUATION ONLY																															
10	10	10	10	10	10	10	10	10	10																						

URE1-6.XLS

PANEL EVALUATION		CARBOMASTIC 90 / CARBOTHANE 134HS																																																		
CLIENT: U.S. ARMY CORPS OF ENG.																																																				
EPOXY URETHANE PROGRAM																																																				
DATE: 6/21/93																																																				
EVALUATION HOURS: 1344																																																				
COATING EVALUATION DATA																																																				
TEST PANEL NUMBER																																																				
ASTM D610 RUST GRADE																																																				
ASTM D714 DEGREE OF BLISTERING, SIZE																																																				
ASTM D714 DEGREE OF BLISTERING, FREQUENCY																																																				
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																																																				
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PANEL EVALUATION		CARBOMASTIC 90 / CARBOTHANE 134HS																																	
CLIENT: U.S. ARMY CORPS OF ENG. EPOXY URETHANE PROGRAM DATE: 7/19/93 EVALUATION HOURS: 2016																																			
COATING EVALUATION DATA																																			
TEST PANEL NUMBER	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">1</td> <td style="width: 10%;">2</td> <td style="width: 10%;">3</td> <td style="width: 10%;">4</td> <td style="width: 10%;">5</td> <td style="width: 10%;">6</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> </table>											1	2	3	4	5	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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0	0	0	0	0	0																														
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RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">0</td> <td style="width: 10%;">0</td> <td style="width: 10%;">0</td> <td style="width: 10%;">0</td> <td style="width: 10%;">0</td> <td style="width: 10%;">0</td> </tr> <tr> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> <td>10</td> </tr> </table>											0	0	0	0	0	0	10	10	10	10	10	10												
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10	10	10	10	10	10																														
TABLE 2, RATING # OF UNSCRIBED AREAS																																			

URE1-6.XLS

PANEL EVALUATION		CARBOMASTIC 90 / CARBOTHANE 134HS																																																																				
CLIENT: U.S. ARMY CORPS OF ENG.																																																																						
EPOXY URETHANE PROGRAM																																																																						
DATE: 8/16/93																																																																						
EVALUATION HOURS: 2688																																																																						
COATING EVALUATION DATA																																																																						
TEST PANEL NUMBER																																																																						
ASTM D610 RUST GRADE																																																																						
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URE1-6.XLS

PANEL EVALUATION		CARBOMASTIC 90 / CARBOTHANE 134HS										
CLIENT: U.S. ARMY CORPS OF ENG.												
EPOXY URETHANE PROGRAM												
DATE: 9/13/93												
EVALUATION HOURS: 3360-FINAL												
COATING EVALUATION DATA												
TEST PANEL NUMBER	1	2	3	4	5	6	COMMENTS					
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edge in this set of panels					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	4	8	8	throughout the exposure period.					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	Few	Few						
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS												
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/64"	1/32"	1/64"	1/64"						
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	9	8	9	9						
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0						
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10						
% Gloss Retention (Avg. of all panels)	90.4%						Yellowing Index: 3.0% more yellow					

URE7-12.XLS

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	CARBOMASTIC 15LO	CARBOTHANE 134 HS	
MANUFACTURER	CARBOLINE	CARBOLINE	
VOLUME % SOLIDS	90% +/- 2%	66% +/- 2%	
VOC	0.74 LB/GAL (88 G/L)	2.4 LB/GAL (288 G/L)	
POT LIFE	4 HOURS AT 75F	6 HOURS AT 75F	
INDUCTION TIME	NONE	NONE	
DRYING TIME MINIMUM TO RECOAT	24 HOURS TO RECOAT	8 HOURS AT 75F FULL CURE - 7 DAYS	
RECOMMENDED FILM THICKNESS, DRY	5-7 MILS DRY / 5.5-7.5 WET	2-4 MILS DRY 3-6 MILS WET	
MIXING RATIOS	1:1 BY VOLUME	8 PARTS A : 1 PART B BY VOLUME	
THINNING	CARBOLINE NO. 76		
APPLICATION DATA			
DATE/TIME	4/9/93 @ 9:00 AM	4/13/93 @ 9:00 PM	
RH	55%	50%	
TEMPERATURE	73F	74F	
SUBSTRATE CONDITION	SSPC VIS. -1C	N/A	
COATING BATCH NUMBERS	A: 3A7722L B: 3A7697L	A: 2F2797M B: 2K0112C	
THINNING	15% WITH NO. 76	NONE	
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	
NUMBER OF COATS	1	1	
SAG INDEX	> 24 MILS	9 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 7	5.8 MILS	6.0 MILS	11.8 MILS
SAMPLE 8	6.1 MILS	6.0 MILS	12.1 MILS
SAMPLE 9	5.6 MILS	7.5 MILS	13.1 MILS
SAMPLE 10	5.3 MILS	6.7 MILS	12.0 MILS
SAMPLE 11	5.0 MILS	7.3 MILS	12.3 MILS
SAMPLE 12	4.4 MILS	7.4 MILS	11.8 MILS
1ST COAT		2ND COAT	
5.8 MILS		6.0 MILS	
6.1 MILS		6.0 MILS	
5.6 MILS		7.5 MILS	
5.3 MILS		6.7 MILS	
5.0 MILS		7.3 MILS	
4.4 MILS		7.4 MILS	
TOTAL		TOTAL	
11.8 MILS		11.8 MILS	

URE7-12.XLS

PANEL EVALUATION		CARBOMASTIC 15LO / CARBOTHANE 134HS									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/10/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
7	8	9	10	11	12	COMMENTS					
0	0	0	0	0	0	There are no effects visible on any panels in this set after 336 hours of exposure.					
0	0	0	0	0	0						
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE7-12.XLS

PANEL EVALUATION		CARBOMASTIC 15LO / CARBOTHANE 134 HS																																																																																																																																																																																																									
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URE7-12.XLS

PANEL EVALUATION		CARBOMASTIC 15LO / CARBOTHANE 134HS									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
7	8	9	10	11	12	COMMENTS					
0	0	0	0	0	0	There are no visible effects on any panels in this set					
0	0	0	0	0	0	after 1344 hours of exposure.					
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE7-12.XLS

PANEL EVALUATION		CARBOMASTIC 15LO / CARBOTHANE 134 HS									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 7/19/93											
EVALUATION HOURS: 2016											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
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MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
7	8	9	10	11	12	COMMENTS					
0	0	0	0	0	0						
0	0	0	0	0	0						
0	0	0	0	0	0						
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

PANEL EVALUATION		CARBOMASTIC 15LO / CAROTHANE 134 HS																																																																																																																																																																					
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EPOXY URETHANE PROGRAM																																																																																																																																																																							
DATE: 8/16/93																																																																																																																																																																							
EVALUATION HOURS: 2688																																																																																																																																																																							
COATING EVALUATION DATA																																																																																																																																																																							
TEST PANEL NUMBER																																																																																																																																																																							
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URE7-12.XLS

PANEL EVALUATION		CARBOMASTIC 15LO / CARBOTHANE 134 HS									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (Average of all panels) 95.4%											
Yellow Index: 64.1% more yellow											
7	8	9	10	11	12						
0	0	0	0	0	0	Blistering on this set of panels has occurred only along the scribe edges throughout the exposure period.					
4	8	8	0	0	0						
Med	Med	Few	0	0	0						
3/32"	1/16"	1/32"	1/64"	1/64"	1/32"						
6	7	8	9	9	8						
0	0	0	0	0	0						
10	10	10	10	10	10						

US ARMY CORP OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	INDUSTRIAL ENAMEL TTE489		
MANUFACTURER	DAVIS INDUSTRIAL COATING		
VOLUME % SOLIDS	N/A		
VOC	N/A		
POT LIFE	N/A		
INDUCTION TIME	N/A		
DRYING TIME MINIMUM	N/A		
RECOMMENDED FILM THICKNESS	N/A		
MIXING RATIOS	N/A		
THINNING	SINGLE COMPONENT		
T-120 SPRAYING THINNER			
APPLICATION DATA			
DATE/TIME	1ST COAT	2ND COAT	3RD COAT
RH	4/12/93 @ 10:00 AM	4/13/93 @ 10:00 AM	4/14/93 @ 10:00 AM
TEMPERATURE	64%	60%	60%
SUBSTRATE CONDITION	75F	73F	73F
COATING BATCH NUMBERS	SSPC VIS. 1-C	SSPC-25 RED OXIDE	TTE489 ENAMEL
THINNING	07172139 LOT 793	01133123 NONE	01133123 NONE
EQUIPMENT	NONE	NONE	NONE
NUMBER OF COATS	BINKS CONVENTIONAL	BINKS CONVENTIONAL	BINKS CONVENTIONAL
SAG INDEX	1	1ST	2ND
	5 MILS	6 MILS	6 MILS
DRY FILM THICKNESS, MILS			
SAMPLE 51	1st COAT	2nd COAT	3rd COAT
SAMPLE 52	2.1 MILS	2.4 MILS	3.5 MILS
SAMPLE 53	2.1 MILS	2.0 MILS	3.6 MILS
SAMPLE 54	1.8 MILS	2.3 MILS	3.3 MILS
SAMPLE 55	2.3 MILS	2.5 MILS	3.0 MILS
SAMPLE 56	2.1 MILS	3.3 MILS	3.1 MILS
	1.9 MILS	2.9 MILS	2.9 MILS
			TOTAL
			8.0 MILS
			7.7 MILS
			7.4 MILS
			7.8 MILS
			8.5 MILS
			7.7 MILS

URE51-56.XLS

PANEL EVALUATION

CLIENT: U.S. Army Corp of Eng.
 EPOXY URETHANE PROGRAM
 DATE: 5/10/93
 EVALUATION HOURS: 336

COATING EVALUATION DATA

TEST PANEL NUMBER
 ASTM D610 RUST GRADE
 ASTM D714 DEGREE OF BLISTERING, SIZE
 ASTM D714 DEGREE OF BLISTERING, FREQUENCY

**ASTM D1654 EVALUATION OF PAINTED
 OR COATED SPECIMENS SUBJECTED
 TO CORROSIVE ENVIRONMENTS**

MEANS CREEPAGE FROM SCRIBE,
 TABLE 1, INCHES

MEAN CREEPAGE FROM SCRIBE,
 TABLE 1, RATING NUMBER

RATING OF UNSCRIBED AREAS,
 TABLE 2, % FAILED

TABLE 2, RATING # OF UNSCRIBED AREAS

SSPC-25 RED OXIDE / TT-E-489 ENAMEL**COMMENTS**

51	52	53	54	55	56
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

FINAL EVALUATION ONLY

FINAL EVALUATION ONLY

URE51-56.XLS

PANEL EVALUATION		SSPC-25 RED OXIDE / TT-E-489 ENAMEL									
CLIENT: U.S. Army Corp of Eng. EPOXY URETHANE PROGRAM DATE: 5/24/93 EVALUATION HOURS: 672											
COATING EVALUATION DATA											
TEST PANEL NUMBER	51	52	53	54	55	56	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	Few					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

URES1-56.XLS

PANEL EVALUATION		SSPC-25 RED OXIDE / TT-E-489 ENAMEL									
CLIENT: U.S. Army Corp of Eng.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER	51	52	53	54	55	56	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0	0 Blisters on Panel No. 51 are in scattered dense				
ASTM D714 DEGREE OF BLISTERING, SIZE	8	0	6	4	0	6	6 groups. Others are localized along edges of				
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	0	Med	Med	0	Med	the scribes.				
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
10%	0	0	0	0	0	0					
6	10	10	10	10	10	10					
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											

URE51-56.XLS

PANEL EVALUATION		SSPC-25 RED OXIDE / TT-E-489 ENAMEL						
CLIENT: U.S. Army Corp of Eng.								
EPOXY URETHANE PROGRAM								
DATE: 7/19/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
51	52	53	54	55	56	COMMENTS		
0	0	0	0	0	0	Except for Panel No. 51 all blistering is localized		
6*	6	6	4	6	6	along scribe edges.		
Med	Med	Dense	Med	Dense	Dense			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
10%	0	0	0	0	0			
6	10	10	10	10	10			

URE51-56.XLS

PANEL EVALUATION		SSPC-25 RED OXIDE / TT-3-489 ENAMEL						
CLIENT: U.S. Army Corp of Eng.								
EXPOXY URETHANE PROGRAM								
DATE: 8/16/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
51	52	53	54	55	56	COMMENTS		
0	0	0	0	0	0	0 Except for Panel No. 51 blistering is along the scribe edges only.		
8	8	4	4	2	4			
Dense	Med	Dense	Dense	Dense	Dense			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
10%	0	0	0	0	0			
6	10	10	10	10	10			

URES1-56.XLS

PANEL EVALUATION		SSPC-25 RED OXIDE / TT-P-489									
CLIENT: U.S. Army Corp of Eng.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEANS CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (average of all panels): 58%											
Yellowing Index: 40% yellowing											

		51	52	53	54	55	56	COMMENTS
		0	0	0	0	0	0	0 Except for Panel 51, all blistering is localized
		8	6	4	4	4	4	4 along scribe edges.
	Dense	Dense	Dense	Dense	Dense	Dense	Dense	

		1/32"	1/64"	1/8"	1/8"	3/16"	1/8"
		8	9	6	6	5	6
		10	0	0	0	0	0
		6	10	10	10	10	10

URE25-97.XLS

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	BAR RUST 236	DEVTHANE 379	
MANUFACTURER	DEVOE	DEVOE	
VOLUME % SOLIDS	80%	62%	
VOC	1.4 LB/GAL (170 G/L)	2.7 LBS/GAL (327 G/L)	
POT LIFE	4 HOURS AT 77F	8 HOURS AT 77F	
INDUCTION TIME	15 MINS AT 77F	NONE	
DRYING TIME MINIMUM TO RECOAT	5 HOURS	FULL CURE 16-24 HOURS AT 77F	
RECOMMENDED FILM THICKNESS, DRY	5-8 MILS DRY, 6-2-10 MILS WET	2-3 MILS DRY, 3-3.5 MILS WET	
MIXING RATIOS	4 PART A : 1 PART B BY VOLUME	4 PARTS A : 1 PART B BY VOLUME	
THINNING	10% MAXIMUM WITH T-10 THINNER	5% MAX WITH T-9 THINNER	
APPLICATION DATA			
DATE/TIME	4/16/93 @ 9:30 AM	4/17/93	
RH	60%	62%	
TEMPERATURE	74F	73F	
SUBSTRATE CONDITION	SSPC VIS. 1-C	BAR RUST 236	
COATING BATCH NUMBERS	A: N302089A B: N302135A	A: N212141C B: C208157	
THINNING	NONE	NONE	
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	
NUMBER OF COATS	1	1	
SAG INDEX	13 MILS	6 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 25	5.6 MILS	4.03 MILS	9.9 MILS
SAMPLE 69	5.3 MILS	3.97 MILS	9.3 MILS
SAMPLE 70	5.0 MILS	4.62 MILS	9.6 MILS
SAMPLE 71	5.1 MILS	2.80 MILS	7.9 MILS
SAMPLE 96	4.8 MILS	2.93 MILS	7.0 MILS
SAMPLE 97	4.4 MILS	3.00 MILS	7.3 MILS

URE25-97.XLS

PANEL EVALUATION		BAR RUST 236 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/10/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER	25	69	70	71	96	97	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

BAR RUST 236 / DEVTHANE 379

EVALUATION HOURS: 672

COATING EVALUATION DATA

ASTM D714 DEGREE OF BLISTERING, FREQUENCY

TABLE 2, RATING # OF UNSCRIBED AREAS

[illegible]

PANEL EVALUATION		BAR RUST 236 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 6/21/93								
EVALUATION HOURS: 1344								
COATING EVALUATION DATA								
TEST PANEL NUMBER	25	69	70	71	96	97	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering is localized along scribe edges.	
ASTM D714 DEGREE OF BLISTERING, SIZE	8	8	8	0	6	8		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Few	Few	Few	0	Few	Few		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

URE25-97.XLS

[illegible]

PANEL EVALUATION

CLIENT: U.S. ARMY CORPS OF ENG.

EPOXY URETHANE PROGRAM

DATE: 8/16/93

EVALUATION HOURS: 2688

COATING EVALUATION DATA

TEST PANEL NUMBER

ASTM D610 RUST GRADE

ASTM D714 DEGREE OF BLISTERING, SIZE

ASTM D714 DEGREE OF BLISTERING, FREQUENCY

ASTM D1654 EVALUATION OF PAINTED

OR COATED SPECIMENS SUBJECTED

TO CORROSIVE ENVIRONMENTS

MEAN CREEPAGE FROM SCRIBE,

TABLE 1, INCHES

MEAN CREEPAGE FROM SCRIBE,

TABLE 1. RATING NUMBER

RATING OF UNSCRIBED AREAS,

TABLE 2. % FAILED

TABLE 2, RATING # OF UNSCRIBED AREAS

BAR RUST 236 / DEVTHANE 379

										COMMENTS
25	69	70	71	96	97					
0	0	0	0	0	0					All blistering is localized along the scribe edges.
4	6	6	6	6	6					
Dense	Med	Med	Med	Dense	Med					
										FINAL EVALUATION ONLY
										FINAL EVALUATION ONLY
0	0	0	0	0	0					
10	10	10	10	10	10					

URE25-97.XLS

PANEL EVALUATION		BAR RUST 236 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (average of all panels): 92.3%											
Yellowing Index: 82.6% more yellow											
COMMENTS											
25	69	70	71	96	97						
0	0	0	0	0	0	Blistering has occurred only along the scribe edges					
4	6	6	6	6	4	throughout the exposure period.					
Dense	Dense	Dense	Dense	Dense	Dense						
5/32"	1/16"	1/32"	1/32"	1/32"	>1/16"						
5	7	8	8	6	6						
0	0	0	0	0	0						
10	10	10	10	10	10						

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	BAR RUST 239	DEVTHANE 379	
MANUFACTURER	DEVVOE	DEVVOE	
VOLUME % SOLIDS	90%	62%	
VOC	0.72 LB/GAL (86 G/L)	2.7 LB/GAL (327 G/L)	
POT LIFE	4 HOURS AT 77F	8 HOURS AT 77F	
INDUCTION TIME	15 MIN AT 77F	NONE	
DRYING TIME MINIMUM TO RECOAT	8 HRS. RECOAT / 24 HRS FULL CURE	16-24 HRS. FULL CURE	
RECOMMENDED FILM THICKNESS, DRY	6-8 MILS DRY / 6.7-8.9 MILS WET	2-3 MILS DRY / 3-3.5 WET	
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME	4 PARTS A : 1 PART B BY VOLUME	
THINNING	12 MILS	T-9 THINNER AT 5% MAX.	
APPLICATION DATA			
DATE/TIME	4/6/93 @ 10:00 AM	4/7/93 @ 10:30 AM	
RH	60%	62%	
TEMPERATURE	74F	73F	
SUBSTRATE CONDITION	SSPC VIS. 1-C	BAR RUST 239	
COATING BATCH NUMBERS	A: N210202 B: N21061	A: N212141-C B: C208157B	
THINNING	10% WITH T-4 THINNER	NONE	
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	
NUMBER OF COATS	1	1	
SAG INDEX	12 MILS	6 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 31A	4.8 MILS	5.1 MILS	9.9 MILS
SAMPLE 32A	6.1 MILS	2.6 MILS	8.7 MILS
SAMPLE 33	6.1 MILS	2.5 MILS	8.6 MILS
SAMPLE 34	5.9 MILS	3.1 MILS	9.0 MILS
SAMPLE 67	5.6 MILS	3.3 MILS	8.9 MILS
SAMPLE 68	5.7 MILS	3.3 MILS	9.0 MILS
1ST COAT		2ND COAT	
4.8 MILS		5.1 MILS	
6.1 MILS		2.6 MILS	
6.1 MILS		2.5 MILS	
5.9 MILS		3.1 MILS	
5.6 MILS		3.3 MILS	
5.7 MILS		3.3 MILS	
TOTAL		TOTAL	
9.9 MILS		9.9 MILS	
8.7 MILS		8.7 MILS	
8.6 MILS		8.6 MILS	
9.0 MILS		9.0 MILS	
8.9 MILS		8.9 MILS	
9.0 MILS		9.0 MILS	

PANEL EVALUATION

CLIENT: U.S. ARMY CORPS OF ENG.

EPOXY URETHANE PROGRAM

DATE: 5/10/93

EVALUATION HOURS: 336

COATING EVALUATION DATA

TEST PANEL NUMBER

ASTM D610 RUST GRADE

ASTM D714 DEGREE OF BLISTERING, SIZE

ASTM D714 DEGREE OF BLISTERING, FREQUENCY

ASTM D1654 EVALUATION OF PAINTED

QB COATED SPECIMENS SUBJECTED

ON COATED SURFACES TO CORROSIVE ENVIRONMENTS

MEAN CREEPAGE FROM SCRIBE,

TABLE 1. INCHES

MEAN CREEPAGE FROM SCRIBE,

TABLE 1. RATING NUMBER

RATING OF UNSCRIBED AREAS,

TABLE 2. % FAILED

TABLE 2. RATING # OF UNSCRIBED AREAS

BAR RUST 239 / DEVTHANE 379

[illegible]

URE31-68.XLS

PANEL EVALUATION		BAR RUST 239 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/24/93											
EVALUATION HOURS: 372											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
31A	32A	33	34	67	68						
0	0	0	0	0	0	There were no visible effects on any panels in this set after 672 hours of exposure.					
0	0	0	0	0	0						
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE31-68.XLS

PANEL EVALUATION		BAR RUST 239 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 6/21/93								
EVALUATION HOURS: 1344								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
31A	32A	33	34	67	68	COMMENTS		
0	0	0	0	0	0	All blistering on these panels is localized along the scribe edges.		
8	8	6	8	0	8			
Few	Med	Med	Med	0	Med			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	0	0	0	0	0			
10	10	10	10	10	10			

URE31-68.XLS

PANEL EVALUATION		BAR RUST 239 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 7/19/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
31A	32A	33	34	67	68			
0	0	0	0	0	0			
6	6	6	6	0	6	All blistering is localized along scribe edge.		
Med	Med	Med	Med	0	Med			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	0	0	0	0	0			
10	10	10	10	10	10			

URE31-68.XLS

PANEL EVALUATION		BAR RUST 239 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 8/16/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
31A	32A	33	34	67	68						
0	0	0	0	0	0						
6	6	6	6	6	6	Blistering is localized along the scribe edges.					
Med	Dense	Dense	Dense	Med	Dense						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE31-68.XLS

PANEL EVALUATION		BAR RUST 239 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (average of all panels): 13.7%											
Yellowing Index: 82.4% yellowing											
31A	32A	33	34	67	68						
0	0	0	0	0	0	Blistering has occurred only along the scribe edges					
6	6	6	6	6	6	throughout the testing period.					
Dense	Dense	Dense	Dense	Dense	Dense						
1/16"	1/16"	5/64"	5/64"	5/64"	1/16"						
7	7	6	6	6	7						
0	0	0	0	0	0						
10	10	10	10	10	10						
COMMENTS											

URE90-95.XLS

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	DEVTRAN 224	DEVTHANE 379	
MANUFACTURER	DEVCO	DEVCO	
VOLUME % SOLIDS	60%	62%	
VOC	2.84 LB/GAL (340 G/L)	2.7 LBS/GAL (327 G/L)	
POT LIFE	8 HOURS AT 77F	8 HOURS AT 77F	
INDUCTION TIME	30 MIN AT 77F	NONE	
DRYING TIME MINIMUM TO RECOAT	5 HOURS	FULL CURE 16-25 HOURS	
RECOMMENDED FILM THICKNESS, DRY	4-6 MILS DRY, 6.7-10 MILS WET	2-3 MILS DRY, 3.3-5 MILS WET	
MIXING RATIOS	1 PART A : 1 PART B BY VOLUME	4 PARTS A : 1 PART B BY VOLUME	
THINNING	10% MAXIMUM WITH T-10 THINNER	5% MAX WITH T-9 THINNER	
APPLICATION DATA			
DATE/TIME	4/6/93 @ 9:00 AM	4/7/93 @ 9:00 AM	
RH	60%	62%	
TEMPERATURE	74F	73F	
SUBSTRATE CONDITION	SSPC VIS. 1-C	DEVTRAN 224	
COATING BATCH NUMBERS	A: N010092C B: C008007	AI N212141C B: C208157	
THINNING	NONE	NONE	
EQUIPMENT	BINKS CONVENTIONAL	BINKS CONVENTIONAL	
NUMBER OF COATS	1	1	
SAG INDEX	13 MILS THINNED 5%	6 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 90	4.3 MILS	2.8 MILS	TOTAL 7.1 MILS
SAMPLE 91	5.2 MILS	3.0 MILS	8.2 MILS
SAMPLE 92	5.0 MILS	3.2 MILS	8.2 MILS
SAMPLE 93	5.5 MILS	2.9 MILS	8.4 MILS
SAMPLE 94	4.9 MILS	3.4 MILS	8.3 MILS
SAMPLE 95	5.6 MILS	2.9 MILS	8.5 MILS

URE90-95.XLS

PANEL EVALUATION		DEVTRAN 224 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/10/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER	90	91	92	93	94	95	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

URE90-95.XLS

PANEL EVALUATION		DEVTRAN 224 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 5/24/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER	90	91	92	93	94	95	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0		
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

URE90-95.XLS

PANEL EVALUATION		DEVTRAN 224 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
90	91	92	93	94	95						
0	0	0	0	0	0	All blistering is localized along scribe edges.					
8	4	0	4	4	4						
Few	Few	0	Med	Few	Med						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE90-95.XLS

PANEL EVALUATION		DEVTRAN 224 / DEVTHANE 379						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 7/19/93								
EVALUATION HOURS: 2016								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
90	91	92	93	94	95	COMMENTS		
0.03%	0	0	0	0	0	Blistering is along the scribe edges only.		
8	4	8	4	4	4			
Dense	Med	Few	Med	Med	Med			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
<1%	0	0	0	0	0			
9	10	10	10	10	10			

PANEL EVALUATION		DEVTRAN 224 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 8/16/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER	90	91	92	93	94	95	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0	All blistering on this set of				
ASTM D714 DEGREE OF BLISTERING, SIZE	6	4	6	2	4	4	panels is localized along				
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Dense	Med	Med	Med	Med	Dense	scribe edges.				
ASTM D 1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

URE90-95.XLS

PANEL EVALUATION		DEVTRAN 224 / DEVTHANE 379									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (average of all panels): 99.3%											
Yellowing Index: 81.5% yellowing											
90	91	92	93	94	95	COMMENTS					
0	0	0	0	0	0	Blistering is localized along scribe edges.					
6	4	6	2	4	4						
Dense	Med	Med	Med	Med	Dense						
1/16"	1/8"	1/64"	3/16"	1/8"	1/8"						
7	6	9	5	6	6						
0	0	0	0	0	0						
10	10	10	10	10	10						

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA		HEMPADUR 4515/1987	
COATING ID		HEMPATHANE 5521/1148	
MANUFACTURER		HEMPEL	
VOLUME % SOLIDS		53%	
VOC		3.8 LBS/GAL 450 G/L	
POT LIFE		2 HOURS AT 68F	
INDUCTION TIME		NONE	
DRYING TIME MINIMUM TO RECOAT		8HRS TO TOUCH, 7 DAYS FULL CURE	
RECOMMENDED FILM THICKNESS, DRY		2 MILS DRY, 4 MILS WET	
MIXING RATIOS		7 PARTS A : 1 PART B	
THINNING		5% MAX WITH NO. 0846 THINNER	
APPLICATION DATA		4/13/93 @ 8:00 AM	
DATE/TIME		4/14/93 @ 9:00 AM	
RH		60%	
TEMPERATURE		73F	
SUBSTRATE CONDITION		HEMPADUR 4515-1987	
COATING BATCH NUMBERS		A: UH2820323 B: UH1030166	
THINNING		5% WITH NO. 0846 THINNER	
EQUIPMENT		NONE	
NUMBER OF COATS		BINKS CONVENTIONAL	
SAG INDEX		1	
1ST COAT		2ND COAT	
10.1 MILS		1.7 MILS	
7.75 MILS		1.9 MILS	
7.10 MILS		1.9 MILS	
7.90 MILS		1.5 MILS	
8.00 MILS		1.9 MILS	
7.10 MILS		2.2 MILS	
TOTAL		TOTAL	
11.8 MILS		11.8 MILS	
9.6 MILS		9.6 MILS	
9.0 MILS		9.0 MILS	
9.4 MILS		9.4 MILS	
9.9 MILS		9.9 MILS	
9.3 MILS		9.3 MILS	

URE39-44.XLS

PANEL EVALUATION		HEMPADUR 4515-1987 / HEMPATANE 5521-1148							
CLIENT: U.S. ARMY CORPS OF ENG.									
EPOXY URETHANE PROGRAM									
DATE: 5/10/93									
EVALUATION HOURS: 336									
COATING EVALUATION DATA									
TEST PANEL NUMBER	39	40	41	42	43	44	COMMENTS		
ASTM D610 RUST GRADE	0	0	0	0	0	0			
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0			
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0			
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS									
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY		
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY		
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0			
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10			

URE39-44.XLS

PANEL EVALUATION		HEMPADUR 4515-1987/HEMPATHANE 5521-1148									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/24/93											
EVALUATION HOURS: 672											
COATING EVALUATION DATA											
TEST PANEL NUMBER	39	40	41	42	43	44	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

URE39-44.XLS

PANEL EVALUATION		HEMPADUR 4515-1987 / HEMPATANE 5521-1148									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL #											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
39	40	41	42	43	44						
0	0	0	0	0	0						
4	4	4	6	2	6	All blistering is localized along the scribe edges.					
Few	Med	Med	Few	Med	Med						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
0	0	0	0	0	10						

URE39-44.XLS

PANEL EVALUATION		HEMPADUR 4515-1987 / HEMPATANE 5521-1148									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 7/19/93											
EVALUATION HOURS: 2016											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
39	40	41	42	43	44						
0	0	0	0	0	0						
4	4	4	6	2	6	Blistering is localized along the scribe edges.					
Med	Med	Med	Faw	Med	Med						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE39-44.XLS

PANEL EVALUATION		HEMPADUR 4515-1987 / HEMPATATHANE 5521-1148									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 8/16/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
39	40	41	42	43	44	COMMENTS					
0	0	0	0	0	0						
4	4	4	6	2	2						
Med	Med	Med-Den	Med	Med	Dense						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE39-44.XLS

PANEL EVALUATION		HEMPADUR 4515-1987 / HEMPATANE 5521-1148									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (average of all panels) : 99.3%											
Yellowing Index: 75.1% yellowing											

	39	40	41	42	43	44	COMMENTS
	0	0	0	0	0	0	Blistering is localized along scribe edges.
	4	4	4	6	2	2	
Dense	Dense	Dense	Dense	Dense	Dense	Dense	
	1/32"	1/16"	1/8"	1/32"	1/8"	1/8"	
	8	7	6	8	6	6	
	0	0	0	0	0	0	
	10	10	10	10	10	10	

URE13-18.XLS

US ARMY CORPS OF ENGINEERS

COATING SYSTEM DATA

COATING ID
MANUFACTURER
VOLUME % SOLIDS
VOC
POT LIFE
INDUCTION TIME
DRYING TIME MINIMUM TO RECOAT
RECOMMENDED FILM THICKNESS, DRY
MIXING RATIOS
THINNING

APPLICATION DATA

DATE/TIME
RH
TEMPERATURE
SUBSTRATE CONDITION
COATING BATCH NUMBERS
THINNING
EQUIPMENT
NUMBER OF COATS
SAG INDEX

DRY FILM THICKNESS, MILS

SAMPLE 13
SAMPLE 14
SAMPLE 15
SAMPLE 16
SAMPLE 17
SAMPLE 18

EPOXY / URETHANE PROGRAM

INTERGARD H.S., UNIVERSAL EPOXY	INTERTHANE
PORTER INTERNATIONAL	PORTER INTERNATIONAL
80% +/- 2%	57% +/- 2%
1.6 LB/GAL (192 G/L)	
4 HOURS AT 75F	10 HOURS AT 75F
15 MIN AT 75F	NONE
6 HOURS	24 HOURS AT 75F
4-8 MILS DRY / 6-10 MILS WET	1.5-2.0 DRY 3-5 WET
4 PARTS A : 1 PART B BY VOLUME	KIT
THINNER #T-44 AT 6% MAX.	GTA415

4/19/93 @ 8:00 A.M.	4/20/93 @ 8:00 A.M.
50%	58%
74F	73F
SSPC VIS. -1C	N/A
A: UHA10993C B: UHA13313C	NOT LEGIBLE
6%	NONE
BINKS CONVENTIONAL	BINKS CONVENTIONAL
1	1
13 MILS THINNED 6%	6 MILS

1ST COAT

6.3 MILS
6.9 MILS
6.5 MILS
6.0 MILS
5.7 MILS
5.3 MILS

2ND COAT

3.6 MILS
2.7 MILS
2.6 MILS
3.5 MILS
3.2 MILS
4.7 MILS

TOTAL

9.9 MILS
9.6 MILS
9.1 MILS
9.5 MILS
8.9 MILS
10.0 MILS

URE13-18.XLS

PANEL EVALUATION		INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/10/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

URE13-18.XLS

PANEL EVALUATION		INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/24/93											
EVALUATION HOURS: 672											
COATING EVALUATION DATA											
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

PANEL EVALUATION		INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
13	14	15	16	17	18	COMMENTS					
0	0	0	0	0	0						
0	0	0	0	0	0						
0	0	0	0	0	0						
0	0	0	0	0	0						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE13-18.XLS

PANEL EVALUATION		INTERGARD H.S. UNIVERSAL EPOXY/INTERTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 7/19/93											
EVALUATION HOURS: 2016											
COATING EVALUATION DATA											
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

PANEL EVALUATION		INTERGARD H.S. UNIVERSAL EXPOXY/INTERTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 8/16/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
13	14	15	16	17	18						
0	0	0	0	0	0						
0	6	0	0	0	8						
0	Few	0	0	0	Few						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	<1%	0	0	0	<1%						
10	9	10	10	10	9						

URE13-18.XLS

PANEL EVALUATION		INTERGARD H.S. UNIVERSAL/INTERTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360 - FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER	13	14	15	16	17	18	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering has occurred only along the scribe edges throughout the exposure period.				
ASTM D714 DEGREE OF BLISTERING, SIZE	0	6	0	0	0	8					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	Few	0	0	0	Few					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/64"	0	1/64"	1/64"					
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	9	10	9	9					
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					
% Gloss Retention (average of all panels): 94.1%											
Yellowing Index: 80.6% more yellow											

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA		HI SOLIDS POLYURETHANE	
COATING ID		SHERWIN-WILLIAMS	
MANUFACTURER		80% +/- 2%	
VOLUME % SOLIDS		1.45 LB/GAL (174 G/L)	
VOC		4 HOURS AT 77F	
POT LIFE		15 MIN AT 77F	
INDUCTION TIME		NONE	
DRYING TIME MINIMUM TO RECOAT		RECOAT: 18HRS FULL CURE: 10 DAYS	
RECOMMENDED FILM THICKNESS, DRY		2 MILS DRY / 4.5 MILS WET	
MIXING RATIOS		4 PARTS A : 1 PART B	
THINNING		R2K4 XYLENE AT 10% MAX.	
APPLICATION DATA		4/14/93 @ 10:00 A.M.	
DATE/TIME		56%	
RH		73F	
TEMPERATURE		N/A	
SUBSTRATE CONDITION		A: 620-4978 B: 630-4281	
COATING BATCH NUMBERS		NONE	
THINNING		BINKS CONVENTIONAL	
EQUIPMENT		1	
NUMBER OF COATS		5 MILS	
SAG INDEX		8 MILS THINNED 5%	
DRY FILM THICKNESS, MILS		1ST COAT	
SAMPLE 27		6.5 MILS	
SAMPLE 28		7.6 MILS	
SAMPLE 29		6.5 MILS	
SAMPLE 30		6.4 MILS	
SAMPLE 31B		7.2 MILS	
SAMPLE 32B		6.0 MILS	
		2ND COAT	
		3.4 MILS	
		3.3 MILS	
		3.5 MILS	
		2.4 MILS	
		2.9 MILS	
		2.6 MILS	
		TOTAL	
		9.9 MILS	
		10.9 MILS	
		10.0 MILS	
		8.8 MILS	
		10.1 MILS	
		8.6 MILS	

URE27-32.XLS

PANEL EVALUATION

CLIENT: U.S. ARMY CORPS OF ENG.
 EPOXY URETHANE PROGRAM
 DATE: 5/10/93
 EVALUATION HOURS: 336

COATING EVALUATION DATA

TEST PANEL NUMBER
 ASTM D610 RUST GRADE
 ASTM D714 DEGREE OF BLISTERING, SIZE
 ASTM D714 DEGREE OF BLISTERING, FREQUENCY

ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS

MEAN CREEPAGE FROM SCRIBE,
 TABLE 1, INCHES
 MEAN CREEPAGE FROM SCRIBE,
 TABLE 1, RATING NUMBER

RATING OF UNSCRIBED AREAS,
 TABLE 2, % FAILED

TABLE 2, RATING # OF UNSCRIBED AREAS

SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE**COMMENTS**

27 28 29 30 31B 32B
 0 0 0 0 0 0
 0 0 0 0 0 0
 0 0 0 0 0 0
 0 0 0 0 0 0

There was no visible effect on any panel in this set after 336 hours of exposure.

FINAL EVALUATION ONLY

FINAL EVALUATION ONLY

URE27-32.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 5/24/93								
EVALUATION HOURS: 672								
COATING EVALUATION DATA								
TEST PANEL NUMBER		27	28	29	30	31B	32B	COMMENTS
ASTM D610 RUST GRADE		0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, SIZE		0	0	0	0	0	0	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY		0	0	0	0	0	0	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED		0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS		10	10	10	10	10	10	

URE27-32.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 6/21/93								
EVALUATION HOURS: 1344								
COATING EVALUATION DATA								
TEST PANEL NUMBER	27	28	29	30	31B	32B	COMMENTS	
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering on Panel 32B occurred at the edges	
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	8	of the scribe.	
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	Few		
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY	
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY	
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0		
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10		

PANEL EVALUATION		SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE					
CLIENT: U.S. ARMY CORPS OF ENG.							
EPOXY URETHANE PROGRAM							
DATE: 7/19/93							
EVALUATION HOURS: 2016							
COATING EVALUATION DATA							
TEST PANEL NUMBER	27	28	29	30	31B	32B	COMMENTS
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blistering on Panel 32B is still localized along the
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	8	scribe edges.
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	Med.	
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0	
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10	

URE27-32.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE						
CLIENT: U.S. ARMY CORPS OF ENG.								
EPOXY URETHANE PROGRAM								
DATE: 8/16/93								
EVALUATION HOURS: 2688								
COATING EVALUATION DATA								
TEST PANEL NUMBER								
ASTM D610 RUST GRADE								
ASTM D714 DEGREE OF BLISTERING, SIZE								
ASTM D714 DEGREE OF BLISTERING, FREQUENCY								
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES								
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER								
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED								
TABLE 2, RATING # OF UNSCRIBED AREAS								
27	28	29	30	31B	32B	COMMENTS		
0	0	0	0	0	0			
0	0	0	8	0	8			
0	0	0	Few	0	Few			
FINAL EVALUATION ONLY								
FINAL EVALUATION ONLY								
0	0	0	<1%	0	<1%			
10	10	10	9	10	9			

URE27-32.XLS

PANEL EVALUATION		SURFACE TOLERANT EPOXY/HI-SOLIDS POLYURETHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER	27	28	29	30	31B	32B	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0	Blisters have occurred only				
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	8	0	8	0 along the scribe edges				
							throughout the testing				
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	Few	0	Few					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	0	1/32"	1/32"	0	1/64"					
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	10	8	8	10	9					
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					
% Gloss Retention (average of all panels): 38.3%											
Yellowing Index: 53.2% more yellow											

URE45-50.XLS

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA		MACROPOXY ALUMINUM	ACROTHANE
COATING ID		SHERWIN WILLIAMS (COOK)	SHERWIN WILLIAMS (COOK)
MANUFACTURER		80%	61% +/- 2%
VOLUME % SOLIDS		1.5 LB/GAL (1175 G/L)	2.88 LB/GAL (346 G/L)
VOC		40 MIN @ 75F	1.5 HOURS @ 75F
POT LIFE		15 MIN @ 75F	NONE
INDUCTION TIME		RECOAT 18-24 HOURS	7 DAYS FULL CURE
DRYING TIME MINIMUM TO RECOAT		6 MILS DRY, 7 MILS WET	1.2-2.5 DRY, 2.5-4.0 WET
RECOMMENDED FILM THICKNESS, DRY		1 PART A : 2 PARTS B BY VOLUME	7 PARTS A : 1 PART B
MIXING RATIOS		250-C-357 (XYLENE)	5% MAX WITH #A19 THINNER
THINNING			
APPLICATION DATA		4/10/93 @ 9:00 AM	4/11/93 @ 10:30 AM
DATE/TIME		51%	55%
RH		73F	72F
TEMPERATURE		SSPC VIS, 1-C	MACROPOXY
SUBSTRATE CONDITION		A: 38-1991010140/1-017 B: 3819912052164	A: 38199115507 B: 700c505
COATING BATCH NUMBERS		10% WITH 250-C-357 XYLENE	NONE
THINNING		BINKS CONVENTIONAL	BINKS CONVENTIONAL
EQUIPMENT		1	1
NUMBER OF COATS		12 MILS	6 MILS
SAG INDEX			
DRY FILM THICKNESS, MILS		1ST COAT	2ND COAT
SAMPLE 45		5.0 MILS	2.1 MILS
SAMPLE 46		5.1 MILS	2.1 MILS
SAMPLE 47		5.4 MILS	1.8 MILS
SAMPLE 48		5.8 MILS	2.9 MILS
SAMPLE 49		5.8 MILS	2.2 MILS
SAMPLE 50		5.9 MILS	2.1 MILS
		TOTAL	TOTAL
		7.1 MILS	7.1 MILS
		7.2 MILS	7.2 MILS
		7.2 MILS	7.2 MILS
		8.7 MILS	8.7 MILS
		8.0 MILS	8.0 MILS
		8.0 MILS	8.0 MILS

PANEL EVALUATION		MACROPOXY ALUMINUM - ACROTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/10/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER	45	46	47	48	49	50	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D 1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

URE45-50.XLS

PANEL EVALUATION		MACROPOXY ALUMINUM / ACROTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/24/93											
EVALUATION HOURS: 672											
COATING EVALUATION DATA											
TEST PANEL NUMBER	45	46	47	48	49	50	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

PANEL EVALUATION		MACROPOXY ALUMINUM / ACROTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
45	46	47	48	49	50						
0	0	0	0	0	0	All blistering is localized along scribe edges.					
4	6	6	4	6	8						
Dense	Med	Few	Dense	Few	Few						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE45-50.XLS

PANEL EVALUATION		MACROPOXY ALUMINUM / ACROTHANE																																																																																																																																													
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PANEL EVALUATION		MACROPOXY ALUMINUM / ACROTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 8/16/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
45	46	47	48	49	50						
0	0	0	0	0	0	All blistering is along the scribe edges.					
4	4	4	2	4	2						
Dense	Med	Dense	Med	Med	Med						
FINAL EVALUATION ONLY											
FINAL EVALUATION ONLY											
0	0	0	0	0	0						
10	10	10	10	10	10						

URE45-50.XLS

PANEL EVALUATION		MACROPOXY ALUMINUM / ACROTHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360-FINAL											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
% Gloss Retention (average of all panels): 70.3%											
Yellowing Index: 94.1% yellowing											
45	46	47	48	49	50						
0	0	0	0	0	0	All blistering is localized along the scribe edges.					
4	4	4	2	4	2						
Dense	Dense	Dense	Dense	Dense	Dense						
7/64"	3/64"	5/64"	9/64"	5/64"	3/64"						
6	7	6	5	6	7						
0	0	0	0	0	0						
10	10	10	10	10	10						
COMMENTS											

US ARMY CORPS OF ENGINEERS		EPOXY / URETHANE PROGRAM	
COATING SYSTEM DATA			
COATING ID	EPTCP ALUMINUM	VHSA POLYURETHANE	
MANUFACTURER	SIGMA COATINGS	SIGMA COATINGS	
VOLUME % SOLIDS	80% +/- 2%		
VOC	2 LBS/GAL (239.6 G/L)	3.10 LB/GAL (371.5 G/L)	
POT LIFE	6 HOURS AT 68F	4 HOURS AT 68F	
INDUCTION TIME	NONE	NONE	
DRYING TIME MINIMUM TO RECOAT	5 HOURS	12HRS MIN 5 DAYS @ 77F FULL CURE	
RECOMMENDED FILM THICKNESS, DRY	5-8 MILS DRY	2-3 MILS DRY	
MIXING RATIOS	3.35:1 BY VOL 5.66 BY WT.	4.88 : 1 BY VOLUME 5.25:1 BY WT	
THINNING	10% MAX. WITH #9192 THINNER	6% MAX WITH #91-88 THINNER	
APPLICATION DATA			
DATE/TIME	4/19/93 @ 8:00 AM	4/19/93 @ 4:00 PM	
RH	65%	64%	
TEMPERATURE	75F	76F	
SUBSTRATE CONDITION	SSPC VIS. -1C	EPTCP ALUMINUM	
COATING BATCH NUMBERS	A: 232-052 B: 136-023	A: 035-023 B: 088-112	
THINNING	10% WITH #91-92 THINNER	NONE	
EQUIPMENT	CONVENTIONAL	BINKS CONVENTIONAL	
NUMBER OF COATS	1	1	
SAG INDEX	14 MILS	7 MILS	
DRY FILM THICKNESS, MILS			
SAMPLE 57	5.3 MILS	4.3 MILS	9.6 MILS
SAMPLE 58	6.0 MILS	3.4 MILS	9.4 MILS
SAMPLE 59	6.9 MILS	4.5 MILS	11.4 MILS
SAMPLE 60	8.1 MILS	4.0 MILS	12.1 MILS
SAMPLE 61	5.9 MILS	3.7 MILS	9.6 MILS
SAMPLE 62	7.0 MILS	3.2 MILS	10.2 MILS
1ST COAT		2ND COAT	
5.3 MILS		4.3 MILS	
6.0 MILS		3.4 MILS	
6.9 MILS		4.5 MILS	
8.1 MILS		4.0 MILS	
5.9 MILS		3.7 MILS	
7.0 MILS		3.2 MILS	
TOTAL		TOTAL	
9.6 MILS		9.6 MILS	
9.4 MILS		11.4 MILS	
12.1 MILS		12.1 MILS	
9.6 MILS		9.6 MILS	
10.2 MILS		10.2 MILS	

URE57-62.XLS

PANEL EVALUATION		EPTCP ALUMINUM / VHSA POLYURETHANE FINISH									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/10/93											
EVALUATION HOURS: 336											
COATING EVALUATION DATA											
TEST PANEL NUMBER	57	58	59	60	61	62	COMMENTS				
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	0	0	0	0	0	0					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES							FINAL EVALUATION ONLY				
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER							FINAL EVALUATION ONLY				
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					

PANEL EVALUATION		EPTCP ALUMINUM / VHSA POLYURETHANE FINISH									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 5/24/93											
EVALUATION HOURS: 672											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											

PANEL EVALUATION		EPTCP ALUMINUM / VHSA POLYURETHANE FINISH									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 6/21/93											
EVALUATION HOURS: 1344											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE,											
TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE,											
TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS,											
TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											

						COMMENTS
57	58	59	60	61	62	
0	0	0	0	0	0	All blistering is localized along scribe edges.
8	8	0	8	8	8	
Few	Few	0	Few	Few	Few	
						FINAL EVALUATION ONLY
						FINAL EVALUATION ONLY
0	0	0	0	0	0	
10	10	10	10	10	10	

PANEL EVALUATION		EPTCP ALUMINUM / VHSA POLYURETHANE																																																																					
CLIENT: U.S. ARMY CORPS OF ENG.																																																																							
EPOXY URETHANE PROGRAM																																																																							
DATE: 7/19/93																																																																							
EVALUATION HOURS: 2016																																																																							
COATING EVALUATION DATA																																																																							
TEST PANEL NUMBER																																																																							
ASTM D610 RUST GRADE																																																																							
ASTM D714 DEGREE OF BLISTERING, SIZE																																																																							
ASTM D714 DEGREE OF BLISTERING, FREQUENCY																																																																							
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS																																																																							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES																																																																							
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER																																																																							
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED																																																																							
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		COMMENTS																																																																					
57	58	59	60	61	62																																																																		
0	0	0	0	0	0	All blistering is localized along scribe edges.																																																																	
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0	0	0	0	0	0																																																																		
10	10	10	10	10	10																																																																		

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PANEL EVALUATION		EPTCP ALUMINUM / VHSA POLYURETHANE									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 8/16/93											
EVALUATION HOURS: 2688											
COATING EVALUATION DATA											
TEST PANEL NUMBER											
ASTM D610 RUST GRADE											
ASTM D714 DEGREE OF BLISTERING, SIZE											
ASTM D714 DEGREE OF BLISTERING, FREQUENCY											
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER											
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED											
TABLE 2, RATING # OF UNSCRIBED AREAS											
57	58	59	60	61	62	COMMENTS					
0	0	0	0	0	0	Blistering is along the					
6	0	0	6	6	4	scribe edges only.					
Med	0	0	Med-Den	Med	Few						
						FINAL EVALUATION ONLY					
						FINAL EVALUATION ONLY					
0	0	0	0	0	0						
10	10	10	10	10	10						

PANEL EVALUATION		EPTCP ALUMINUM / VHSA POLYURETHANE FINISH									
CLIENT: U.S. ARMY CORPS OF ENG.											
EPOXY URETHANE PROGRAM											
DATE: 9/13/93											
EVALUATION HOURS: 3360											
COATING EVALUATION DATA											
TEST PANEL NUMBER	57	58	59	60	61	62					
ASTM D610 RUST GRADE	0	0	0	0	0	0					
ASTM D714 DEGREE OF BLISTERING, SIZE	6	8	4	6	6	4	All blistering is localized along scribe edges.				
ASTM D714 DEGREE OF BLISTERING, FREQUENCY	Med	Med	Med	Med	Med	Med					
ASTM D1654 EVALUATION OF PAINTED OR COATED SPECIMENS SUBJECTED TO CORROSIVE ENVIRONMENTS											
MEAN CREEPAGE FROM SCRIBE, TABLE 1, INCHES	1/32"	1/64"	1/64"	1/32"	1/32"	1/64"					
MEAN CREEPAGE FROM SCRIBE, TABLE 1, RATING NUMBER	8	9	9	8	8	9					
RATING OF UNSCRIBED AREAS, TABLE 2, % FAILED	0	0	0	0	0	0					
TABLE 2, RATING # OF UNSCRIBED AREAS	10	10	10	10	10	10					
% Gloss Retention (average of all panels): 92.1%											
Yellowing Index: 86.7% yellowing											

Appendix C: Commercial Item Description of a Coating System for Minimally Prepared Atmospheric Steel–Aluminum Epoxy Mastic

Abstract

This commercial item description covers the requirements for a high build aluminum pigmented epoxy coating system. The product shall be suitable for application at temperatures of 40 °F (4.4 °C) and above to minimally prepared rusted and/or painted ferrous metal substrates. Wide latitude is afforded the formulator provided the product meets the specification requirements when tested as described herein. The coating shall not contain lead, chromium, cadmium, or chlorinated solvents. In addition to the manufacturers standard label, the product shall be labeled with the title and number of this commercial item description.

Salient Characteristics

The coating shall comply with the following requirements.

Application Properties¹

The coating shall not sag, run, or streak when applied by brush, spray, or roller at the manufacturer's recommended thickness.

Appearance of the Dried Paint Film²

The dried paint film shall have no visible cracks or fractures.

¹ The coating shall be applied at the manufacturer's recommended film thickness by brush, roller, and conventional and airless spray.

² The applied paint shall be inspected under 30X magnification after drying for 1 week.

Dry Time³

The coating shall dry hard in not more than 16 hours.

Pot Life⁴

The viscosity of the mixed coating shall not increase by more than 10 Krebs units (KU) in 3 hours.

Intercoat Adhesion⁵

When tested as specified, the coating shall exhibit no intercoat delamination.

Accelerated Corrosion Resistance⁶

None of the six test panels shall blister adjacent to the scribe earlier than the inspection at 2688 hours. No more than 1, 4, and 6 test panels shall blister adjacent to the scribe at 2688, 3360, and 4032 hours respectively. For all six test panels, the average numerical blister rating for the area adjacent to the scribe shall not be less than 6.5. The blister rating shall be the average of the sum of the average numerical ratings for frequency and size. Frequency ratings shall be converted as follows: 10 = none, 8 = few, 6 = medium, 4 = medium dense, 2 = dense, 0 = total. Any blistering not immediately adjacent to the scribe shall be cause for rejection. The average rust rating for the six panels and the minimum rust rating for any one test panel shall not be less than 9.0. The rust undercut rating for any panel shall not be less than 6.0 and the average rust undercut rating for all six panels shall be greater than 6.0. The sum of the average rust, blister, and undercut scores shall not be less than 23.0.

³ The time to dry hard shall be determined for the epoxy coating applied at the recommended film thickness in accordance with ASTM D 523-89.

⁴ The initial viscosity of a 1-qt (0.095 L) sample of thoroughly mixed coating shall be determined by ASTM D 562. The viscosity shall be measured a second time after 3 hr.

⁵ Two successive coats of the test material shall be spray-applied to the designated dry film thickness. The applied paint shall be cured and aged at 70 to 75 °F (21 to 24 °C) and 50 ±10 percent relative humidity for 72 hr between coats and for 7 days after the application of the second coat. A sharp knife shall be used to produce two parallel scribes through the coating approximately 1 in. long and 1/4-in. apart. A third scribe shall be made perpendicular to and through the parallel scribes. The knife shall be used to determine the intercoat adhesion by attempting to delaminate the second coat from the first along the perpendicular scribe.

⁶ The corrosion resistance of the aluminum epoxy mastic system shall be evaluated using this test procedure.

Volatile Organics⁷

The volatile organic content of the mixed and thinned coating shall not exceed 350 g/L.

Preparation of Test Specimens

Pre-rusted test specimens measuring 3.0 x 9.0 x 0.125 in. shall be prepared in accordance with SSPC Coatings Test Panel Preparation Specification No. 1, *Uncontaminated Rusted Steel* (SSPC Draft Specification No. 2, January 1995).

Application of Paint System

The first coat of aluminum epoxy mastic shall be spray-applied to the recommended dry film thickness and allowed to cure for 18 to 24 hours at 72 ± 2 °F (22 ± 1 °C) and 50 ± 5 percent relative humidity. The second coat of epoxy shall be spray applied and allowed to dry for a minimum of 7 days prior to testing. Prior to exposure, test panels shall be scribed in accordance with ASTM D1654 such that the coating is uniformly removed down to the substrate along the entire length of the scribe.

Cyclic Test Exposure

Six test coupons of the aluminum epoxy coating system shall be exposed in accordance with ASTM G 85, Annex A5, and ASTM G 53 with the following modifications and conditions. The concentration of the dilute salt solution shall be 0.4 percent ammonium sulfate and 0.05 percent sodium chloride. The salt spray temperature shall be 30 °C and the dry-off temperature 40 °C. The UV-condensing cabinet shall use UV-A bulbs and be run at 60 °C during the 4h UV cycle and at 50 °C during the 4h condensation cycle. Samples shall be exposed alternately for 1 week in the G 53 cabinet followed by 1 week in the G 85 cabinet for a total of 4032h.

Inspection and Evaluation of Test Coupons

The coatings shall be evaluated for rusting, blistering, and rust undercutting at the scribe in accordance with ASTM D610, SSPC-Vis. 2, ASTM D714, and ASTM D1654. A transparent grid overlay shall be used to enhance the results of the visual examination. Panels shall be evaluated after 332, 672, 1344, 2016, 2688, 3360, and 4032 hours of exposure, except that undercutting at the scribe shall only be determined after 4032 hours.

⁷ The VOC content of the mixed, ready-to-apply material shall be determined in accordance with USEPA method 24.

Quality Assurance

Responsibility

Unless otherwise specified, the contractor is responsible for the performance of all inspection requirements specified herein. The Government reserves the right to perform any of the inspections set forth when deemed necessary to assure that the material conforms to the prescribed requirements.

Inspection

Sampling shall be in accordance with ASTM D 3925. Testing shall be conducted in a Government-approved testing facility using the manufacturer's designated dry film thickness applied in the recommended number of coats. Generally this system will be applied in two coats with a total dry film thickness of 8 to 14 mils. Failure to meet any requirement specified herein shall be cause for rejection.

1. First article inspection when specified shall include all tests of salient characteristics, and may be standard production material from the supplier's current inventory.
2. Quality conformance inspection shall include all of the requirements specified herein with the exception of the provisions for accelerated corrosion resistance and volatile organics unless otherwise specified.
3. Coatings shall be subject to inspection for requalification purposes every 3 years, or at which time that the product is reformulated. The requirements shall be the same as for first article inspection.

Certification

The contractor shall certify, and maintain substantiating evidence, that the products conform to the producer's own specifications, standards, and quality assurance practices. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be otherwise provided for by the contract.

Packaging

Materials shall be packaged and marked as specified in ASTM D 3951. The manufacturer of the material shall provide material safety data sheets and instructions for application of the product.

Further Notes

Note 1

This coating system is primarily for use on hand- or power tool-cleaned exterior steel substrates in normal or industrial atmospheres. It may also be used for interior areas that are dry or subject to high humidity and condensation. In some cases this system may be used to overcoat existing coating systems as a means of extending their service life. An assessment of the current coating condition and the application of a test patch of the proposed overcoat material must be conducted before scheduling the painting contract. Higher grades of surface preparation, such as commercial blast cleaning, may be selected at the discretion of the specifier. Commercial blast cleaning may be appropriate for complete removal of a heavily deteriorated coating system. Grades of surface preparation higher than SP-6 will not significantly improve the performance of the coating system and do not warrant the added expense.

Note 2

At least 6 months should be allowed for the qualification of any manufacturers brand of aluminum epoxy mastic paint. Because of the long time necessary to qualify coatings, the purchaser should consider selecting a previously qualified coating.

Suggested Sources

Source	Product
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Carbomastic 15LO
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Carbomastic 90 Aluminum
Devco Coatings Company 4000 DuPont Circle Louisville, KY 40207	Bar Rust 239
Sherwin-Williams 101 Prospect Ave., NW Cleveland, OH 44115-1075	Epoxy Mastic Aluminum II

Appendix D: Commercial Item Description of a Coating System for Minimally Prepared Atmospheric Steel—Epoxy Primer/Urethane Topcoat

Abstract

This paint system consists of a commercially available epoxy mastic primer and urethane topcoat produced by a single manufacturer and marketed for use as a system. The coating system is suitable for use on minimally prepared rusted and/or painted ferrous metal substrates. Wide latitude is afforded the formulator, provided the system meets the requirements as specified herein. The coatings shall not contain lead, chromium, cadmium, or chlorinated solvents. As a minimum, the topcoat shall be available in white, black, grey, and safety yellow. Qualification testing shall be performed on systems using the white topcoat.

Salient Characteristics

The coating system shall comply with the following requirements when tested.

Application Properties¹

The primer and topcoat shall not sag, run, or streak when tested as specified.

Appearance of the Dried Paint Film²

When tested as specified the primer shall have no visible cracks.

¹ The primer and topcoat shall be applied by brush, roller, and conventional and airless spray at the manufacturer's recommended thicknesses.

² The dried coatings shall have a smooth uniform appearance. A dried film of the epoxy primer shall exhibit no cracks or fractures when examined under 30X magnification.

Dry Time³

The primer shall dry-hard in less than 8 hours and the topcoat in less than 6 hours.

Pot Life⁴

The viscosities of the mixed primer and mixed topcoat shall not increase by more than 10 Krebs units (KU) over a 4-hr period.

Intercoat Adhesion⁵

When tested as specified, the topcoat shall show no intercoat delamination from the primer.

Volatile Organics⁶

The volatile organics content of the ready to apply primer and topcoat shall not be greater than 350 g/L and 420 g/L respectively.

Cyclic Corrosion Test⁷

No more than two panels shall exhibit blistering adjacent to the scribe after 1344 and 2016 hours of testing. No more than four panels shall exhibit blistering adjacent to the scribe after 2688 and 3360 hours of testing. The average of the sum of the final numerical blister ratings shall not be less than 8.0. The blister rating shall be the average of the sum of the average numerical ratings for frequency and size. Frequency ratings shall be converted as follows: 10 = none, 8 = few, 6 = medium, 4 = medium dense, 2 = dense, 0 = total. Blistering not immediately adjacent to the scribe shall be cause for rejection. The final rust rating for each of the six test panels shall be 10. No single test panel shall have a rust undercut rating of less than 5.0 and the average

³ The time to dry-hard shall be determined for the primer and topcoat applied at the recommended film thicknesses in accordance with ASTM D 1640-83 (Reapproved 1989).

⁴ The viscosity of 1-qt samples of epoxy primer and urethane topcoat shall be determined immediately after mixing and 4 hours later in accordance with ASTM D 562-82 (Reapproved 1990).

⁵ The primer/topcoat system shall be spray applied to the recommended film thickness. The primer shall be air dried for 72 hours at 72 ± 2 °F (22 ± 1 °C) and 50 ± 5 percent relative humidity prior to application of the topcoat. The topcoat shall be allowed to dry 7 days prior to testing. A sharp knife shall be used to produce two parallel scribes through the coating approximately 1 in. long and 1/4-in. apart. A third scribe shall be made perpendicular to and through the parallel scribes. The knife shall be used to determine the intercoat adhesion by attempting to delaminate the urethane topcoat from the epoxy primer along the perpendicular scribe.

⁶ The volatile organic content of the primer and topcoat shall be determined in accordance with the requirements of USEPA Method 24.

⁷ The corrosion resistance of the epoxy/urethane coating system shall be evaluated using this test procedure.

scribe rating for the six test panels shall not be less than 7.0. The sum of the average blister, rust, and undercut ratings shall not be less than 25.0.

Preparation of Test Specimens

Prerusted test specimens measuring 3.0 x 9.0 x 0.125 in. shall be prepared in accordance with SSPC Coatings Test Panel Preparation Specification No. 1, *Uncontaminated Rusted Steel* (SSPC Draft Specification No. 2, January 1995).

Application of Paint System

The primer shall be spray-applied to the recommended dry film thickness and allowed to cure for 18 to 24 hours at 72 ± 2 °F (22 ± 1 °C) and 50 ± 5 percent relative humidity. The topcoat shall be spray applied and allowed to dry for a minimum of 7 days prior to testing. Prior to exposure test panels shall be scribed in accordance with ASTM D 1654 such that the coating is uniformly removed down to the substrate along the entire length of the scribe.

Cyclic Test Exposure

Six test coupons of the epoxy/urethane coating system shall be exposed in accordance with ASTM G 85, Annex A5, and ASTM G 53 with the following modifications and conditions. The concentration of the dilute salt solution shall be 0.4 percent ammonium sulfate and 0.05 percent sodium chloride. The salt spray temperature shall be 30 °C and the dry-off temperature 40 °C. The UV-condensing cabinet shall use UV-A bulbs and be run at 60 °C during the 4h UV cycle and at 50 °C during the 4h condensation cycle. Samples shall be exposed alternately for 1 week in the G 53 cabinet followed by 1 week in the G 85 cabinet for a total of 3360h.

Inspection and Evaluation of Test Coupons

The exposed test coupons shall be evaluated for rusting, blistering, and rust undercutting at the scribe in accordance with ASTM D 610, SSPC Vis. 2, ASTM D 714, and ASTM D 1654 after 1344, 2016, 2688, and 3360 hours of exposure except that rust undercutting at the scribe shall only be rated at the completion of testing.

Quality Assurance

Responsibility

Unless otherwise specified, the contractor is responsible for the performance of all inspection requirements specified herein. The Government reserves the right to perform any of the inspections set forth when deemed necessary to assure that the material conforms to the prescribed requirements.

Inspection

Sampling shall be in accordance with ASTM D 3925. Testing shall be conducted in a Government-approved testing facility using the manufacturer's designated dry film thickness applied in the recommended number of coats. Generally this system will be applied in two coats with a total dry film thickness of 8 to 14 mils. Failure to meet any requirement specified herein shall be cause for rejection.

1. First article inspection when specified shall include all tests of salient characteristics, and may be standard production material from the supplier's current inventory.
2. Quality conformance inspection shall include all of the requirements specified herein with the exception of the provisions for accelerated corrosion resistance and volatile organics unless otherwise specified.
3. Coatings shall be subject to inspection for requalification purposes every 3 years, or at which time that the product is reformulated. The requirements shall be the same as for first article inspection.

Certification

The contractor shall certify, and maintain substantiating evidence, that the products conform to the producer's own specifications, standards, and quality assurance practices. The Government reserves the right to require proof of such conformance prior to first delivery and thereafter as may be otherwise provided for by the contract.

Packaging

Materials shall be packaged and marked as specified in ASTM D 3951. The manufacturer of the material shall provide material safety data sheets and instructions for application of the product.

Further Notes

Note 1

This coating system is intended primarily for use on hand- or power tool-cleaned exterior steel substrates exposed to rural or industrial atmospheres where finish colors other than aluminum are desired. It may also be used for interior surfaces that are dry or subject to high humidity and condensation. In some cases this coating system can be used to overcoat existing coating systems as a means of extending their service life. An assessment of the current coating condition and the application of a test patch of the proposed overcoat material must be conducted to determine the viability of the overcoat option. Higher grades of surface preparation, such as SSPC-SP 6, *Commercial Blast Cleaning*, may be selected at the discretion of the specifier. SP 6 may be appropriate for the complete removal of a deteriorated coating system. Better grades of surface cleaning than SP 6 will not significantly improve the performance of the coating system and do not warrant the higher cost.

Note 2

At least 6 months should be allowed for the qualification of any manufacturers system. Because of the long time period required for qualification, the Contractor should consider selecting a previously qualified system.

Suggested Sources

Source	Product
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Primer: Carbomastic 90 Topcoat: Carbothane 134HS
Carboline 350 Hanley Industrial Court St. Louis, MO 63144	Primer: Carbomastic 15LO Topcoat: Carbothane 134HS
International /Courtalds Coatings 6001 Antoine Houston, TX 77210-4806	Primer: Intergard H.S. Universal Epoxy Topcoat: Interthane
Sherwin-Williams 101 Prospect Ave, NW Cleveland, OH 44115-1075	Primer: Surface-Tolerant Epoxy Topcoat: Hi Solids Polyurethane

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